University of Liverpool

Investigation of lymphatic filariasis distribution, morbidity management and disability prevention in Bangladesh

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Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor of Philosophy in Tropical Medicine

By

Israt Hafiz

29th March 2018

Dedication

I would like to dedicate this to the most influential people in my life;

1. Md Abdul Latif, my beloved husband who always supports and inspires me
2. My daughters, Mahreen Latif Othai & Riasha Ishmam, believing and wanting the best for me,
3. My supervisor, Louise Kelly-Hope who made it possible by giving extraordinary support
4. My sisters and brother for unconditional love, prayers and support

Abstract

Lymphatic filariasis (LF), a mosquito-borne parasitic disease, is a major cause of disability in Bangladesh with an estimated 70 million people at risk of infection and tens of thousands suffering from the main clinical conditions. LF is targeted for elimination as part of the Global Programme to Eliminate LF (GPELF), which aims to interrupt transmission through mass drug administration (MDA) and providing patient care to those affected through morbidity management and disability prevention (MMD). Since 2001, the National LF Elimination Programme in Bangladesh has successfully scaled up MDA and of interrupted transmission. More recently the LF Programme has focussed on MMDP strategies, however there were significant gaps in knowledge, little understood about the distribution of disease and local communities and health workers. In this context, this research project aimed to address the current status of LF disability and its management including i) to examine the historical distribution of clinical cases in an endemic district, ii) determine the number and prevalence of LF after MDA activities, iii) to determine the knowledge, attitude, practices (KAP) of community members and patients and iv) to assess the workload, experience and perspectives of community health workers (CHWs) for morbidity control in a highly endemic district.

The descriptive and statistical analysis of historical data in Nilphamari district found that cases of lymphoedema were widespread and cases of hydrocoele were more clustered in one area of the district. Women were more affected by lymphoedema and men by hydrocoele, and older people were more affected by clinical condition and people with more advanced disease suffered from more acute attacks. A cluster survey conducted in Nilphamari district after MDA activities in 2012, including 1242 people found low prevalence of clinical cases LF with very few cases especially in people less than 30 years old and the leg being the most affected body part. Women were more affected by lymphoedema and men by hydrocoele. A KAP study conducted in the same district demonstrated that community members and people affected by LF were aware of the National LF Programme and some measures to care for themselves. However, despite good awareness campaign by National LF Programme it was revealed that there is practice of some inappropriate and unhygienic measures like cutting by fish bones/knife and Jharfoak (A local term meaning traditional healing based on people's belief). A KAP study conducted on CHW revealed that knowledge about MDA and morbidity control was impressive before any large scale MMDP activities. However, the CHWs expressed that they have too much workload, inadequate training and lack of incentives for good practice related to morbidity control.

These results will help the National Programme better understand the distribution of clinical disease and what practices to put in place. Bangladesh is progressing well towards the elimination of LF. At this stage national programme will need to demonstrate that services are integrated into health systems for long term sustainable support for patients – as their condition are chronic and many individuals will remain affected for many more decades. This

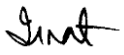
study result will provide guidance on where to focus targeted activities on morbidity control and how best to utilize the CHW to integrate.

Declaration

I hereby certify that this dissertation constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions or writings of another.

I declare that the dissertation describes original work that has not previously been presented for the award of any other degree of any institution.

Signed,



Israt Hafiz

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Most importantly, none of this could have happened without my family. My husband Md Latif, who offered his unfailing support and continuous encouragement. With his own brand of humour, he has been kind and helped me through the process. Every time I was ready to quit, you did not let me and I am forever grateful. To my daughters Mahreen Latif Othai and Riasha Ishmam and my sisters– it would be an understatement to say that, as a family, we have experienced some ups and downs in the past seven years. This dissertation stands as a testament to their unconditional love and encouragement. Thank you.

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List of Key Abbreviations

ADLA	Acute dermatolymphangioadenitis
Ag	Antigenaemia
BBS	Bangladesh Bureau of statistics
BMRC	Bangladesh Medical Research Council
CDC	Centres for Disease Control
CHW	Community Health Workers
CI	Confidence intervals
DALY	Disability Adjusted Life Years
DEC	Diethylcarbamazine citrate acid
DFID	Department of international development
DGHS	Directorate General of Health Services
DNA	Deoxyribonucleic acid
GPELF	Global Program to Eliminate Lymphatic Filariasis
ICT	Iimmunochromatographic card test
IEC	Information, Education, Communication
IRS	Indoor residual spraying
ITN	Insecticide treated nets
KAP	Knowledge, attitudes and practices
LF	Lymphatic filariasis
L1	First stage larvae
L2	Second stage larvae
L3	Third stage larvae (infective larvae stage found in mosquitoes)
L4	Fourth stage larvae
LLIN	Long lasting insecticide nets
NGO	Non-Government Organization
NTD	Neglected tropical diseases
MDA	Mass drug administration
Mf	Microfilariae
MMDP	Morbidity Management and Disability Prevention
MOHFW	Ministry of Health & Family Welfare
PCR	Polymerase chain reaction
SEAR	South-East Asian Region
TAS	Transmission Assessment Survey
Wb	*Wuchereria bancrofti*
WHA	World Health Assembly
WHO	World Health Organization

Chapter One

Literature Review and Thesis Objectives

1. Introduction

1.1 Lymphatic Filariasis

Lymphatic filariasis (LF) is a vector-borne parasitic infection and one of the leading causes of permanent long-term disability in the world. It is classified as one of the neglected tropical diseases (NTDs) by the World Health Organization (WHO), which are a diverse group of diseases mainly affecting people living in poverty (WHO, 2013, 2017). It is caused by three species of parasitic worms *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori* which are transmitted to humans by a variety of mosquito species. The majority of infections (~90%) are caused by the *W. bancrofti* parasite. An estimated 120 million of people in 73 countries are infected with at least one of these parasite species, with about 40 million people suffering from disabling clinical manifestation such as lymphoedema and hydrocele. In recognition of this significant public health problem, the World Health Assembly (WHA) adopted a resolution in 1997 (WHA 50.29) and called upon member states to develop national plans that would lead to the elimination of LF as a public health problem (WHO 2017).

1.2 Global Programme to Eliminate Lymphatic Filariasis (GPELF)

The WHO established the Global Programme of Elimination of Lymphatic Filariasis (GPELF) with the goal of LF elimination as a public health problem by the year 2020. To achieve the global goal of a two-fold strategy was been taken. First, to interrupt transmission using combinations of two medicines delivered to entire population at risk known as mass drug administration (MDA). Second, to alleviate suffering of people with the clinical manifestations, including lymphoedema and hydrocele, by providing morbidity management and disability prevention (MMDP).

GPELF has been one of the most rapidly expanding public health programmes. In the first decade, GPELF saw an extraordinary scale up of activities. GPELF has developed several important guidelines in different languages for the endemic countries. Subsequently GPELF

identifies the challenges and expanded elimination programmes to achieve full coverage. GPELF also developed metrics for monitoring and reporting of programmes. The elimination targets has been achieved in several endemic countries and many more in process of validation with the aim to declare elimination (WHO 2012; WER 2017).

1.3 Global geographical distribution of lymphatic Filariasis

Lymphatic filariasis (LF) is a disabling and disfiguring mosquito-borne parasitic disease, and one of the leading causes of permanent long-term disability in the world. It is classified by the WHO as one of the NTDs, which are a diverse group of diseases mainly affecting people living in poverty (WHO, 2013, 2017). In recognition of significant worldwide burden in 1997, WHA called upon Member states to develop national plans that would lead to elimination of LF. In 2000, the GPELF was launched with a goal of eliminating LF as a public health problem by 2020 by interrupting transmission through MDA and addressing patient care through MMDP (WHO, 2013; Ramaiah KD et al, 2014). Recent estimates indicate that approximately 1.4 billion people living in 73 tropical and sub-tropical countries (WHO-WER, 2011) are at risk of infection, with an estimated 16.7 million people potentially affected by lymphoedema (limbs and breast swelling) and 19.4 million men by hydrocoele. The geographical and environmental limits are estimated in models maps as shown in Figure 2.1. It has been reported that there are 45 countries have lymphoedema and 40 countries have hydrocele patients all over the world (WHO-WER 2017). Currently only 34 endemic countries have reported MMDP services, shown in Table 1.1 (WHO-WER 2017).

1.4 Lymphatic Filariasis in the South-East Asia Region

LF is endemic in countries within mainland of South East Asia Region (SEAR). The WHO South -East Asia accounts for 55.7% of the at-risk population with 94.6 % of reported lymphoedema cases and 85.2% of reported hydrocele cases globally (WHO 2013, WER 2016; Dickson et al, 2017). Elimination of LF in this geographical area would have a significant impact on the global disease burden. Countries with the heaviest burden include India, Bangladesh and Indonesia. LF in the SEAR is caused *by W. bancrofti* and *B. malayi* and transmitted mainly by *Culex quinquefasciatus. Aedes spp*. and *Mansoniua spp.* mosquitoes.

Overall the SEAR region is progress well despite some challenges. MDA is still required in 5 countries. Bangladesh and Thailand have stopped MDA nationwide after post-MDA

surveillance activities using the Transmission Assessment Survey (TAS) tool (WHO- WER, 2017). Nepal has stopped MDA in 31 out of 61 endemic districts. The challenge is some bordering districts of India where the TAS has failed. The challenge for India is developing strategies to ensure improved compliance with each additional round of MDA (WHO, 2017).

Overall the lack of reporting of MMDP activities is of concern in the SEAR and there is a focus for countries to improve this (WHO, 2017). This may be more readily achieved once National programmes finish MDA activities and can then begin to prioritize MMDP services.

1.5 Lymphatic Filariasis in Bangladesh

Bangladesh, a densely populated country in the SEAR and a major LF endemic country. The burden of LF is considered to be immense with the highest rates of infection and an estimated 70 million people (approximately half the total population) were considered to be at risk of LF infection, with tens of thousands of people suffering from various forms of clinical presentation, including limb lymphoedema/elephantiasis and hydrocele (Hafiz et al, 2015).

In Bangladesh, LF is caused by *Wuchereria bancrofti* and transmitted by *Culex* mosquitoes (WHO, 2014, Ramaiah et al, 2014). The Bangladesh LF Programme was launched in 2001. To assess which districts required MDA, the LF Programme took a conservative approach and used a combination of the three parameters to select MDA eligibility; i) Mf prevalence, ii) antigenaemia (Ag) prevalence, and iii) frequency of clinical cases. Baseline prevalence mapping and historical data indicated that the disease was highly endemic in 19 of the 64 districts and considered eligible for MDA. This was based on the available Ag and Mf rates of between 1% and 17% and evidence of clinical cases (Saha et al, 2011, Wolfe et al. 1972). The burden was found to be highest in Rangpur Division in the north, where 23% Mf prevalence and up to 10% chronic disease have been reported (MOHFW, 2010; Wolfe et al, 1971). A further 15 districts were found to be endemic but considered to have low endemicity (according to antigen (Ag) tests in 2002-2004) and therefore not considered eligible for MDA.

The Directorate General of Health Services (DGHS) has been very supportive and committed to the LF programme which is managed through the Ministry of Health and Family Welfare (MOHFW). Over the past 10-15 years the main focus of the programme has been on scaling up MDA activities across the 19 highly endemic districts, which has included extensive social mobilization, Information, Education and Communication (IEC) activities and in some recent

years, morbidity control services (WHO, 2000). The MDA activities have been very successful, and all endemic districts are currently under post-MDA surveillance (Shamsuzzaman et al. 2017).

The LF Programme has more recently focussed its activities on MMDP and the scale up of home-based morbidity control in highly endemic districts. In the northern Rangpur Division, the first extensive patient searching was conducted in 2005 with more than 40,000 patients found. In selected hospitals, surgeries for men with hydroceles were initiated and some home-based care training conducted. Even though data on clinical cases were available, at the start of this thesis, the data has not been examined, there had been no recent study determining prevalence and severity of recent clinical condition after several rounds of MDA, and further little was known about the health workers situation and what support would be required to implement a large-scale morbidity control programme.

1.6 Parasite, vectors and life cycle

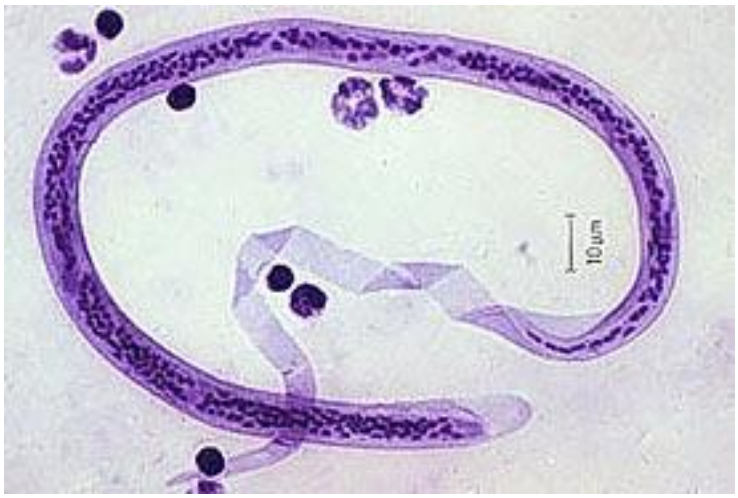
LF is caused by nematodes (roundworms) that inhabit the lymphatic vessels and lymph nodes of a human host. *Wuchereria bancrofti, Brugia malayi and Brugia timori* cause lymphatic filariasis. Part of their life cycle is in vector mosquito. Female mosquito transmitted among human while taking their blood meals. Among the mosquito *Anopheles*, *Culex*, *Mansonia* , *Aedes* species are habitat in different areas. In Bangladesh, the most common parasite is *Wuchereria bancrofti* (Ramaiah, et al., 2011). The following Table 2.2 shows the periodicity and distribution and main vectors of different parasite causing LF (WHO, 2016).

Table 1.1 Periodicity and distribution of organisms that cause human lymphatic filariasis

Organism	Periodicity	Distribution	Main vector
Wuchereria bancrofti	Nocturnal periodic	Worldwide, including Africa, Indonesia, Melanesia, Micronesia, Middle East, South America, South Asia	*Anopheles, Culex*
	Nocturnal sub-periodic	South-East Asia	*Aedes*
	Diurnal sub-periodic	Polynesia	*Aedes*
Brugia malayi	Nocturnal periodic	India, Indonesia, South-East Asia	*Anopheles, Mansonia*
	Nocturnal sub-periodic	Indonesia, South-East Asia	*Mansonia*
	Diurnal sub-periodic	Thailand	*Mansonia*
Brugia timori	Nocturnal periodic	Alor, Flores, Indonesia, Roti, Timor	*Anopheles*

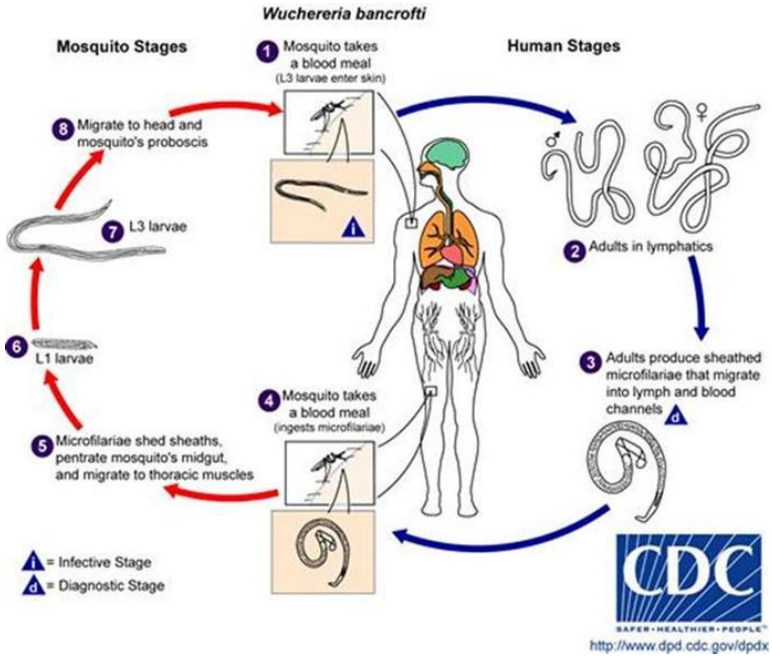
(Source WHO, 2013).

Figure 1.1 Microfilaria of *Wuchereria bancrofti*



Source Parasitology

Figure 1.2 Life cycle of *Wuchereria bancrofti*



"During a blood meal, an infected mosquito introduces third-stage filarial larvae onto the skin of the human host, where they penetrate into the bite wound ❶. They develop in adults that commonly reside in the lymphatics ❷. The female worms measure 80 to 100 mm in length and 0.24 to 0.30 mm in diameter, while the males measure about 40 mm by .1 mm. Adults produce microfilariae measuring 244 to 296 µm by 7.5 to 10 µm, which are sheathed and have nocturnal periodicity, except the South Pacific microfilariae which have the absence of marked periodicity. The microfilariae migrate into lymph and blood channels moving actively through lymph and blood (Figure 1.1) ❸. A mosquito ingests the microfilariae during a blood meal ❹. After ingestion, the microfilariae lose their sheaths and some of them work their way through the wall of the proventriculus and cardiac portion of the mosquito's midgut and reach the thoracic muscles ❺. There the microfilariae develop into first-stage larvae (L1) ❻ and subsequently into a second stage (L2) and then third-stage infective larvae (L3) ❼. The third-stage infective larvae (L3) migrate through the hemocoel to the mosquito's prosbocis ❽ and can infect another human when the mosquito takes a blood meal ❶." (Figure 1.2)

Source: Centers for Disease Control (CDC) https://www.cdc.gov/parasites/lymphaticfilariasis/biology_w_bancrofti.html

1.7 Pathogenesis of LF

The disease develops as a result of the infective larvae (L3) deposited on the skin of the human host, where it penetrates the skin, and then enters the bloodstream and lymphatics and where they develop into adult worms. One main site for adult parasites to develop is the scrotal lymphatics in men or boys after puberty, and these can be seen by ultrasonography known as 'filarial dance sign' (Noroes et al. 1996; Dreyer et al 1999). Other common sites are in the larger lymph vessels and lymph nodes draining to lower and upper limbs, and commonly seen in women (Mand et al, 2004; Fox LM et al, 2005). Adult worms can be detected by Doppler sonography in the lymphatics of the inguinal and axillary regions (Shenoy RK et al, 2007). The adult parasites live in these human body sites for long time; 6-8 years or more, and are responsible for initiating the early pathology in host (Drayer et al, 2000).

The earliest structural change is the dilation of lymph vessels where the adult worms live. This has been demonstrated in subjects who are clinically asymptomatic except for presence of microfilariae (mf) in blood, by ultrasound examination of the lymphatics of the spermatic cord; lymphoscintigraphy of the limbs and by direct examination of lymph vessels resected

by surgery (Noroes et al, 1996). Dilatation of the lymph vessels has been demonstrated by lymphoscintigraphy (Shenoy et al, 2007). It is believed that this damage to lymph vessels is caused by the adult parasites through chemicals from them, causing vessel dilatation or inhibit contractility (Gyapong et al, 2005). Over time this pathology results in dysfunction. It is noted that during this early stage of LF infection, the host having the adult parasites does not have any evidence of clinical manifestation and this phase is known as asymptomatic microfilaremia. It has been reported that once established this lymphatic pathology is irreversible even after treatment or death of the filarial parasite and promotes progression of LF disease (Freedman et al, 1994).

Once this lymphatic damage progresses, stasis of lymph tends to occur in the dilated vessels due to incompetence of the unidirectional valves in them. This damage is aggravated by bacterial infections of the limb, prolonged standing or strenuous exertion. The transient lympho-paralysis that sets in during acute bacterial infections also abets the lymph stasis. Stagnation of lymph encourages growth of bacteria invading the region. Any interference with the skin integrity of the affected region like injuries, fungal or bacterial infections, fissuring of the skin, and paronychia or eczema favour entry of pathogenic bacteria into the tissues infection (Shenoy et al, 1999). These bacteria, mainly streptococci and occasionally other pathogens, are responsible for the acute attacks of dermato-lymphangio-adenitis (ADLA) commonly seen in filarial limbs (Shenoy et al, 2007). Bacteria have been cultured from the skin and lymph from the oedematous limb (Olszewski et al, 1997; Olszewski , 1994).

1.8 Diagnosis and diagnostic tools

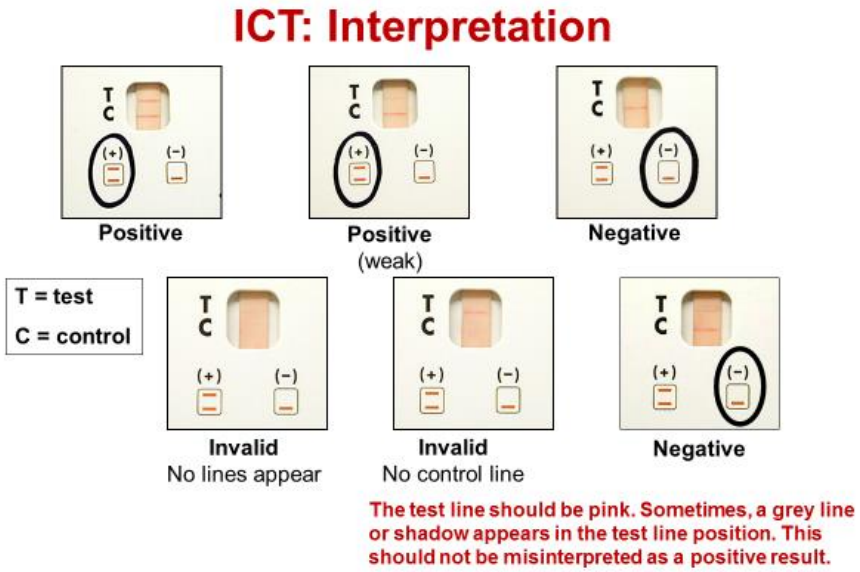
There are several methods for diagnosis if LF infection. Detection of Mf by direct or thick film techniques was used traditionally. Where LF is nocturnally periodic thick blood smear is completed at night corresponding to the time of maximum mf density. This test is superseded by highly sensitive and more convenient antigen and antibody-based tests (Dickson, 2017).

Detection of antigen test include immunochromatographic card test (ICT) and Og4C3 enzyme- linked immunosorbent assays (ELISA). ICT test result is shown in figure 1.3. This test uses monoclonal antibodies to detect secretory-excretory antigens produced by adult filaria (Weil et al., 1987; Weil et al.,1997). As antigen is produced in different stage of life, antigen

test is two to five-fold more sensitive that thick smear test. It can be done at day time. Og4C3 has higher sensitivity than ICT but they are less practical in the field (Gass et al, 2012).

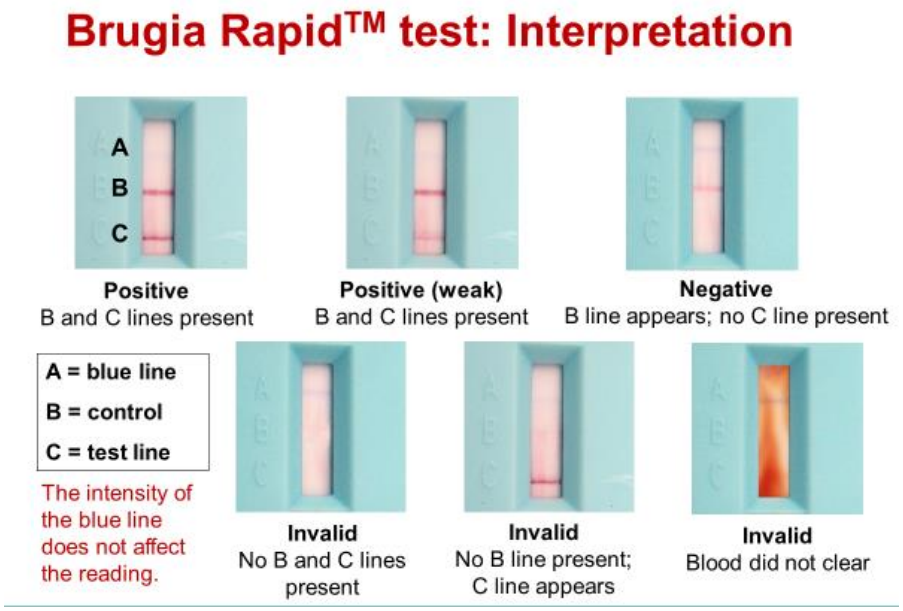
Antibody based tests detect IgG4 antibodies against Bm14 antigen (*B. malayi and W. Bancrofti) or BmRI (B. malayi* only). It is highly sensitive and specific, but it cannot prove current infection as antibody remain elevated for many years after infection. Interpretation is shown in figure 1.4. Less commonly antibody in urine can be tested. However, urine antibody is less sensitive than blood based antibody and are not available commercially. PCR assays to detect LF DNA in humans may be used to diagnose LF. It is not used in endemic countries as it needs advanced laboratory facilities but it is more sensitive than other tests (Gass et al, 2012, Rebolo et al, 2014).

Figure 1.3 Showing ICT test interpretation



(Source WHO training module)

Figure 1.4 Showing Brugia rapid test interpretation

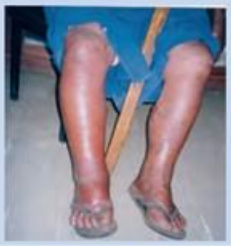


(Source-WHO MMDP, 2013)

1.9 Clinical symptoms

The main manifestations of LF disease include i) lymphoedema, with more severe cases known as elephantiasis, defined as advanced stage disease based on Dreyer staging and ii) hydrocoele in men. Many LF patients also suffer from acute infections described above i.e. ADLAs or acute attacks, which can be very painful and disabling (WHO, 2013). The photos in Figure 1.5 show the clinical conditions as presented by the WHO on their main LF website (WHO 2017).

Figure 1.5 Clinical manifestation of LF

Clinical manifestation		Treatment
Acute dermatolymphangioadenitis		Antibiotics, antipyretics, analgesics
Lymphoedema and elephantiasis		Hygiene, antibacterial creams, antifungal creams
Hydrocoele		Surgery

(Source WHO-MMDP, 2017)

Acute Dermatolymphangioadenitis (ADLA) is acute Inflammation of the skin, lymph vessels and lymph glands, resembles erysipelas or cellulitis. It is characterized by local pain and swelling and with fever and chills (WHO, 2013). Acute attack of ADLA precipitates lymphedema for the first time in an affected limb, usually starting in childhood. Such repeated attacks later perpetuate and worsen the lymphedema leading to elephantiasis. Lack of local hygiene favours more such attacks and a vicious cycle is thus established (Shenoy RK et al, 1998)]. Advanced stages of lymphedema are characterized by increasing dilation and tortuosity of the lymphatics, endothelial proliferation, formation of new lymph channels, and obstructive changes and dermatosclerosis with nodular and warty changes. Some study showed positive correlations between the Dreyer stage of the worse leg and i) number of episodes of ADLA, ii) number of interdigital lesions, and iii) number of abnormal nails (McPherson et al, 2006)

Lymphoedema

lymphoedema is a condition of localized fluid retention and tissue swelling caused by a compromised lymphatic system, which normally returns interstitial fluid to the thoracic duct, then the bloodstream (WHO, 2013). LF is one of the important causes of lymphoedema of limbs in tropical countries.

Lymphoedema and its more advanced form elephantiasis, occur primarily in the lower limbs. May be in upper limb, breast and genitalia less frequently. It is commoner in females. Progression of lymphoedema has been implicated by several factors. Repeated episodes of ADLA is one important factors. Obviously its most advanced form of diseases, elephantiasis may prevent people from carrying out their normal activities. Although filarial lymphoedema is distinguished from condition such as heart failure, malnutrition, venous disease, podoconiosis and HIV/AIDS associated Kaposi's sarcoma, there is no agreement on its classification. However, Stemmer's sign (Figure 1.6) is a diagnostic sign of lymphoedema. A positive Stemmer's sign is inability to pinch a skin fold of skin at the base of the toes.

Podoconiosis, known as non filarial lymphoedema is prevalent in highland tropical areas of Africa, Central America and north-west India where there is commonly a high seasonal rainfall. has similar consequences of lymphoedema, It is also considered as NTD and requires same management for LF lymphoedema (Kebede el al, 2018). Podoconiosis are neglected tropical diseases (NTDs) that pose a significant physical, social and economic burden to endemic communities. Patients affected by the clinical conditions of LF (lymphoedema and hydrocoele) and podoconiosis (lymphoedema) need access to morbidity management and disability prevention (MMDP) services. It is often termed "non-filarial" lymphoedema, and can be generally clinically distinguished from LF lymphoedema by its ascending progression of disease (rather than descending), and by being most commonly bilateral, as compared with LF which is most commonly descending and unilateral (Kebede el al, 2018).

Figure 1.6 Stemmer's sign is a diagnostic sign of lymphoedema

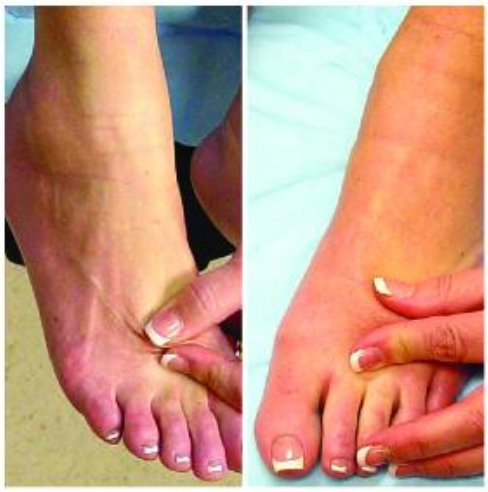
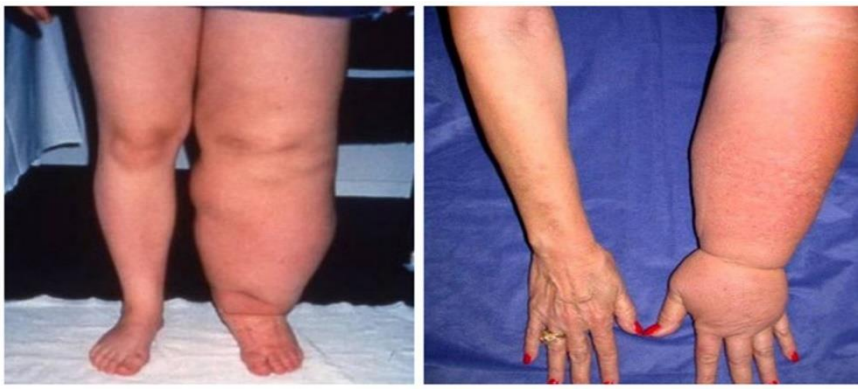


Figure 1.7 Difference between normal and lymphoedema leg



(Source Medscape, 2017).

Stages of lymphoedema

Based on severity different stages and graded was done. WHO defined following stages (Figure 1.8) are widely accepted for morbidity management. The seven stages are as follows

Stage 1: Lymphoedema reversible overnight;

Stage 2: Irreversible lymphoedema with normal skin;

Stage 3: Irreversible lymphoedema with thickened skin and shallow folds whose base is visible;

Stage 4: Irreversible lymphoedema with knobs (bumps and lump);

Stage 5: Irreversible lymphoedema with deep folds whose base is visible when separated by finger;

Stage 6: Irreversible lymphoedema with mossy foot;

Stage 7: With irreversible lymphoedema, disability to do routine activities adequately

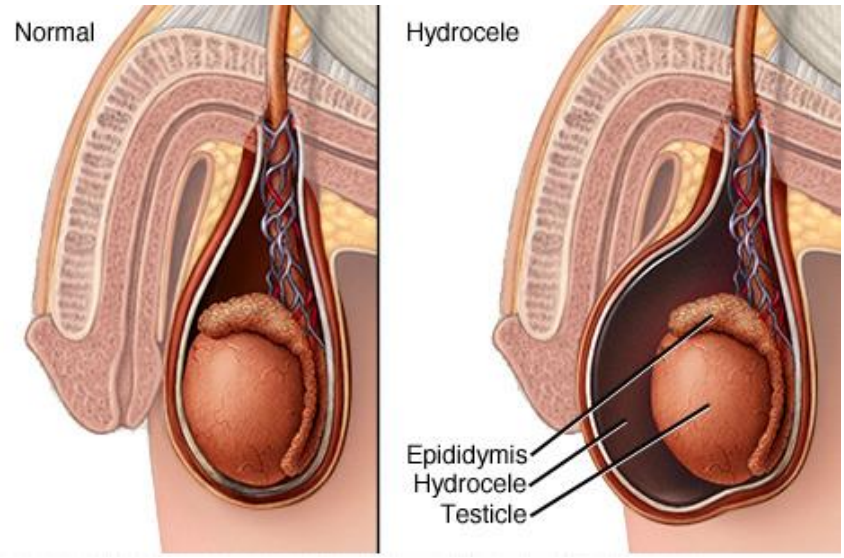
Figure 1.8 Stages of lymphoedema

(Source Dreyer et al, 2000)

Hydrocele

A hydrocele is a type of swelling in the scrotum that occurs when fluid collects in the thin sheath surrounding a testicle (Figure 1.9). Boys and adult men can develop a hydrocele due to inflammation or injury. LF is one of the common cause in tropical countries (WHO, MMDP 2013).

Figure 1.9 Difference between normal scrotum and hydrocele



(Source Mayo foundation for medical education and research)

Historically the size of the hydrocele has been described as to the one of a tennis ball and used it as a criterion for repartition of the cases in two categories only: lesser or greater than a tennis ball. Such enlargement of the scrotum described as “monstrous” by an observer, will be only the size of a “big orange” (or papaya) for another observer who will distinguish it from a “small” or “medium orange” (or papaya), which is not more accurate (Capuano & Capuano, 2011).

1) Type of hydrocele

Unilateral or bilateral.

2) Side of hydrocele

Right or left side of the scrotum

3) Size of hydrocele

Hydroceles were classified according to their size into six stages By Capuano, 2011 (Figure 1.10).

The stages are recorded in roman numerals.

• Stage I: The size of the scrotum is less than that of a tennis ball.

• Stage II: The size of the scrotum is greater than that of a tennis ball up and down; the lower pole of the scrotum does not reach halfway up the thigh (between the lower edge of the great trochanter and the top edge of the knee identified by the upper edge of the patella).

• Stage III: The lower pole of the scrotum goes down to mid-thigh and reaches the area between mid-thigh and the knee (upper edge of the patella).

• Stage IV: The lower pole of the scrotum reaches the area between the upper edge of the patella and the lower edge of the knee (tibial tuberosity).

• Stage V: The lower pole of the scrotum reaches the area between the lower edge of the knee (tibial tuberosity) and mid-leg.

• Stage VI: The lower pole of the scrotum reaches the area between mid-leg and the ankle (bi-malleolar line).

4) Burial of the penis

The burial of the penis, which often accompanies hydroceles, can be assessed on the patient standing or lying down. The burial was classified according to its importance, in five categories or Grades from zero to four recorded in arabic numerals:

• Grade 0: no apparent burial, the length of the penis is within normal limits

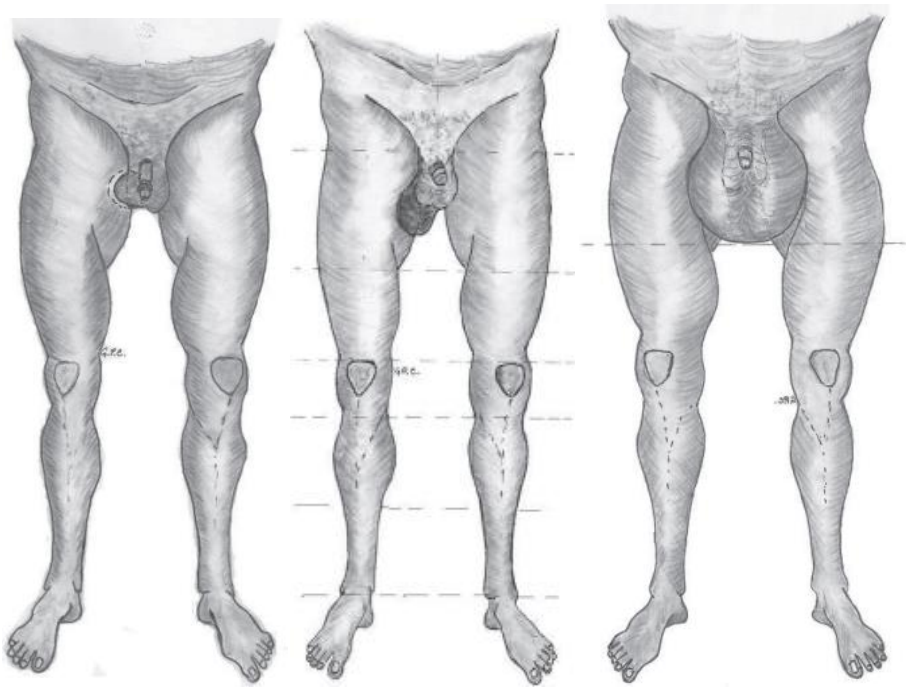
• Grade 1: partial burial, the length of the visible part of the penis is more than 2cm.

• Grade 2: more important partial burial, the length of the visible part of the penis is less than 2cm.

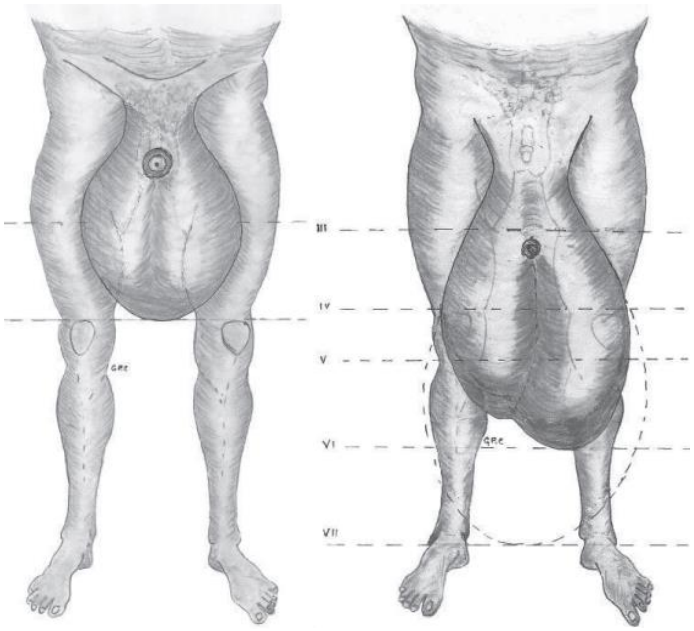
• Grade 3: total burial of the penis. The prepuce, or the tip of the glans penis if the patient is circumcised, is visible and flush with the surface of the scrotum

• Grade 4: total burial of the glans penis which is invisible, the burial cannot be reduced and causes micturition problems

Figure 1.10 Staging of Hydrocele



Stage I Stage II Stage III

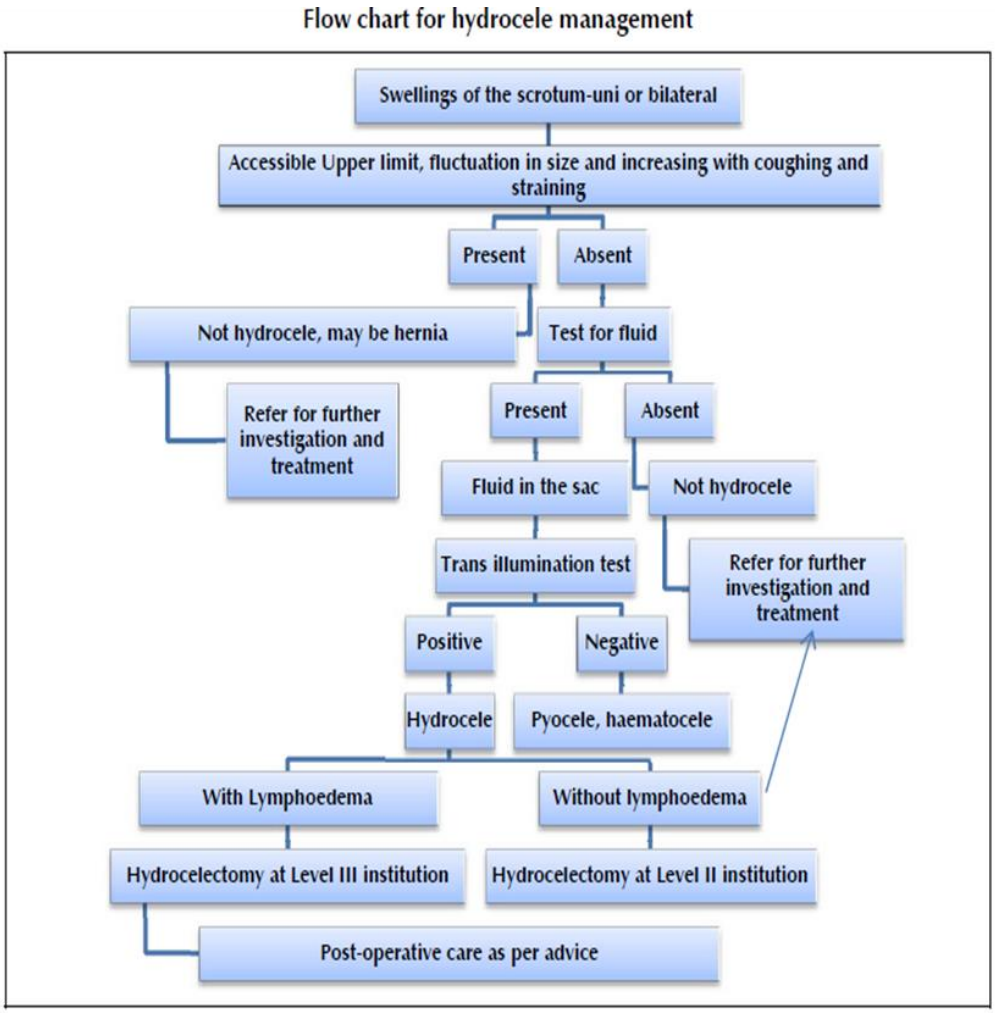


Stage IV Stages V and VI

(Source-Capuano & Capuano, 2011).

Management of Hydrocele

Figure 1.11 Flowchart of management of hydrocele (Source; WHO MMDP, 2013)



Treatment: excision of hydrocele (Capuano G.P.& Capuano C, 2011).

- Type of anaesthesia: spinal anaesthesia or general anaesthesia (complicated).

Surgical procedure included following steps

The fasting patients were hospitalized the day before or the morning of the surgery for clinical, biological and electro-cardio graphic assessment and usual preparation (shaving of the designated surgical area, shower).

All hydroceles were treated by total vaginectomy using the following technique:

- Access: anterolateral right (for unilateral right hydrocele) or anterolateral left (for unilateral left

- hydrocele) or anterolateral right and left separately (for bilateral hydrocele).
- Section of the different layers under the scrotum with the electrocautery knife accompanied by a step-by-step electrocautery for perfect haemostasis.
- Identification of the spermatic cord as high as possible to the root of the scrotum and isolation.
- Externalization of the mass after complete dissection by fingers, electrocautery knife and Metzenbaum scissors.
- Fluid sample taking by needle and syringe for the laboratory.
- Content emptying by electric suction.
- Complete vertical opening of the vaginalis on its front side by electrocautery knife from the drain suction hole to the lower pole at the level of the handle of the deferent and then up until the cord.
- Inventory and examination of the testis and epididymis
- Removal of related lesions by electrocautery knife: hydatids, cysts of the head or of the tail of the

  epididymis. Complete resection of the parietal layer of the tunica vaginalis by electrocautery knife as close as possible to the path of its continuation as the visceral layer. Haemostatic cuticular suture on the cut margin on the periphery of the testes using absorbable sutures 000.
- Fixation of the testis to the lower pole of the scrotum (or the neo-scrotum if the patient had a scrotal reduction by plasty, see below).
- Closing in two layers on Delbet drain (corrugated rubber blade)
- Use of non-absorbable sutures for ligatures and suture of the deep layers and of the skin in a second time.

In a few cases the importance of the excessive scrotum after treatment of the hydrocele justified a reduction by plasty. Similarly, in some instances the burial of the penis was not spontaneously reduced during the operation and a surgical reduction was performed. Both procedures were made using surgeon's own techniques.

postoperative dressing and follow up

Complementary treatment: excision of epididymal cysts, hydatids or other associated conditions discovered during the surgical treatment of the hydrocele;

- Treatment of the scrotum: by simple closure or by personal technique of scrotal reduction by plasty.
- Reduction of a burial of the penis: spontaneous during surgery or by surgical treatment; epididymal cysts, hydatids or other associated conditions discovered during the surgical treatment of the
- hydrocele;
- Treatment of the scrotum: by simple closure or by personal technique of scrotal reduction by plasty.
- Reduction of a burial of the penis: spontaneous during (Capuano G.P.& Capuano C, 2011).

Available medications can kill some species of filarial parasites, but they cannot reverse advanced clinical manifestations of filarial infections such as blindness or elephantiasis. On the other hand, simple methods have been developed for lymphoedema management that reduce the frequency of filarial fever attacks and often lead to significant improvement in patients with severe lymphoedema or elephantiasis (Mend et al, 2012).

Most filarial parasite species contain intracellular bacteria called Wolbachia that are required for parasite development and reproduction. Antibiotic treatments that clear Wolbachia can sterilize and eventually kill adult filarial worms that contain Wolbachia (Taylor t al., 2005).

Large-scale programmes are using donated drugs to control and, in some cases, actually eliminate onchocerciasis and lymphatic filariasis in many disease-endemic countries. In the short term, mass drug administration programmes cure infections and prevent disease. However, the long-term goal of these programmes is global elimination of onchocerciasis and lymphatic filariasis.

Doxycycline has been identified as an anti-morbidity drug for the treatment of filariasis (elephantiasis) (Taylor t al., 2005). On study shows minocycline is superior than doxycycline regimen as anti-Wolbachia microfilariae (Sharma et al, 2016). Mand, et al.,2012 has demonstrated Doxycycline improves filarial lymphedema independent of active filarial infection in a randomized controlled trial.

Morbidity management and disability prevention (MMDP) in lymphatic filariasis

WHO suggested basic management of lymphoedema involves simple measures, which can usually be carried out by the patient. The complete set of measures is more complex but usually cannot be implemented in resource poor settings. Where there is comprehensive health system, health workers could promote use of complete package including compression or pressure bandages, lymphatic massage and other recognised methods. Traditional health workers like CHWs should be involved in management wherever possible (WHO-MMDP, 2013).

Community home-based prevention

Lymphoedema is the main problem in filariasis. It mostly worsens due to negligence in the initial treatment. Once lymphoedema develops, it cannot revert to normal condition after certain stage.

But encouragingly, it also does not deteriorate if regular self-care is adopted. A deranged lymphatic system lowers the resistance to infection. If it is infected repeatedly, the condition worsens, and it becomes a source of constant suffering. Hygiene of the part prevents infection by fungus and bacteria. If regular care is taken at home, acute attacks are prevented to a great extent. Care of an affected part needs to be taken almost throughout life, often assisted by family and community.

The important prerequisite for community home-based care is to entrust a person, either from family, friends or community, apart from the LF sufferer, to assist and monitor the home-based care. The affected part needs to be observed keenly to detect the points/sites of the entry lesions regularly, especially the inter-digital spaces and the skin folds. The following are the key components:

Figure 1.12 Measures for managing lymphoedema (Source; WHO MMDP, 2013)

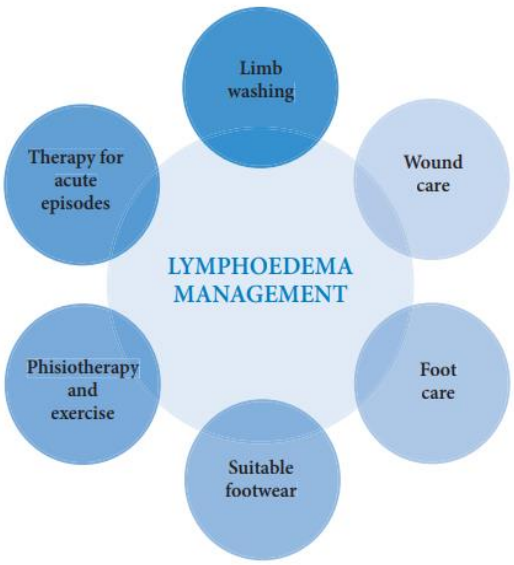


Figure 1.13 Flowchart of management of Lymphoedema

(Source; WHO MMDP, 2013)

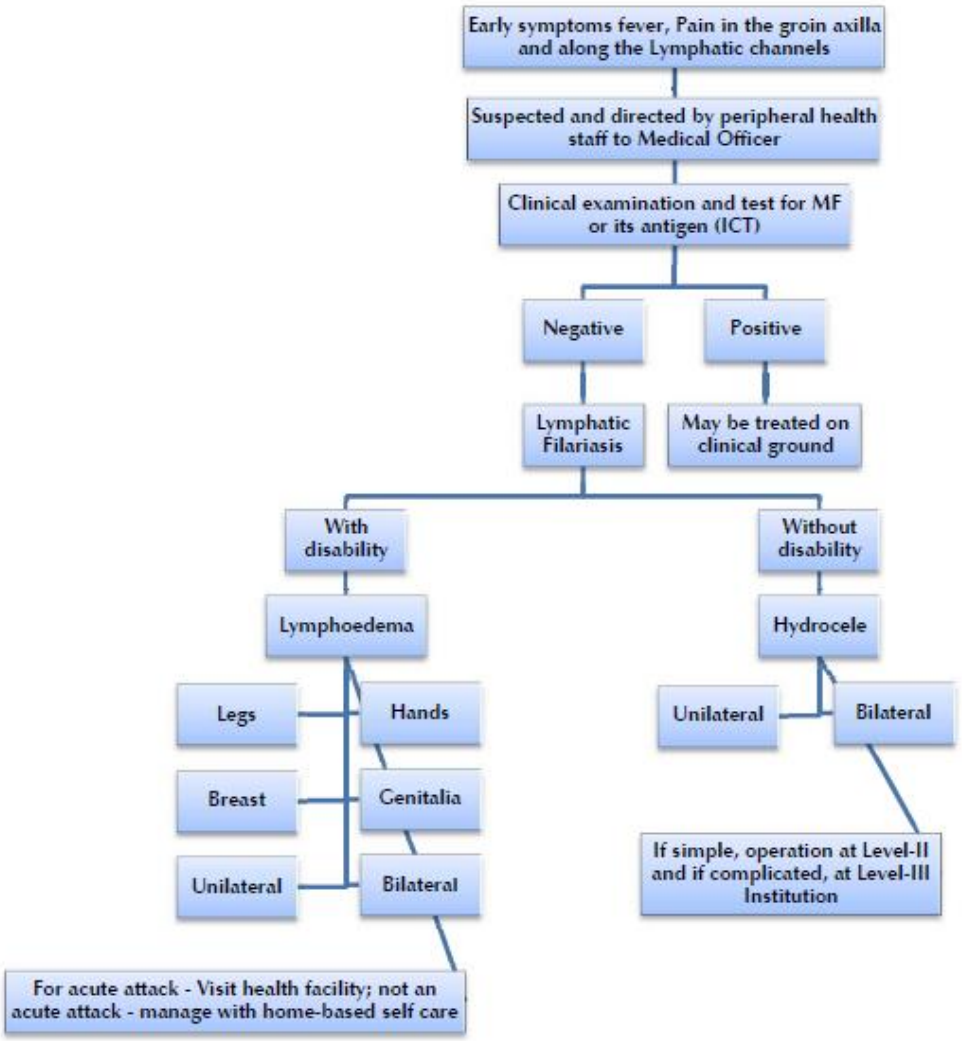
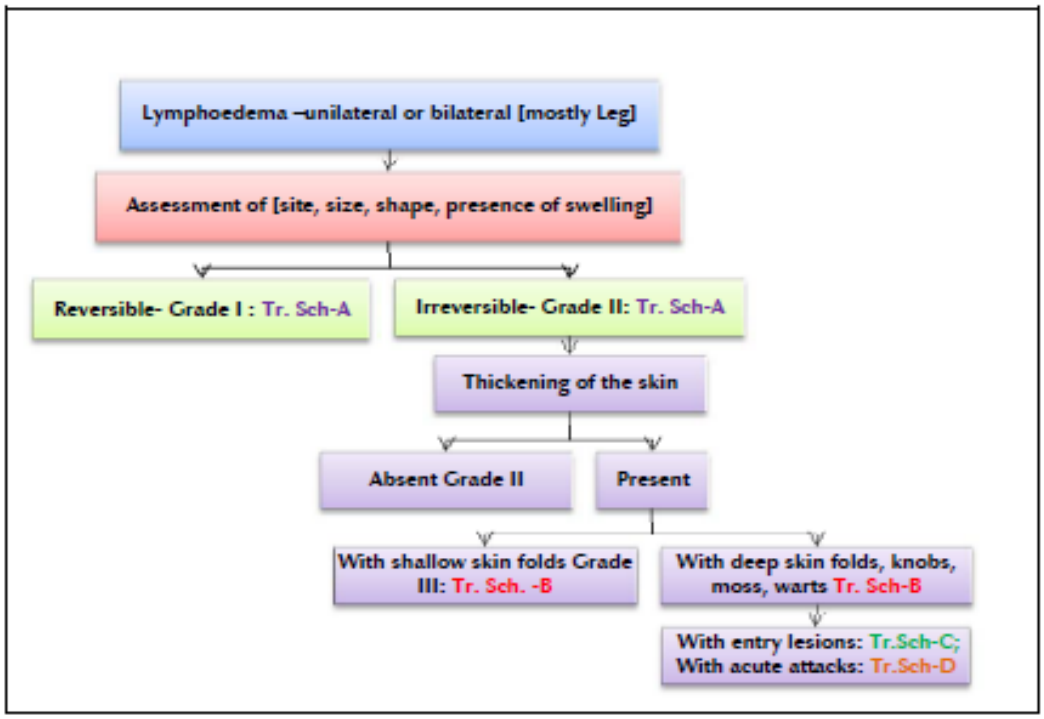


Figure 1.14 Flowchart of management of Lymphoedema cont'd



Management/treatment schedules			
Schedule –A	Schedule –B	Schedule –C	Schedule –D
• Skin hygiene, washing & drying • Elevation • Exercise • Footwear • Massage • Bandage • Psychosocial support	• Skin hygiene, washing & drying • Elevation • Exercise • Footwear • Massage • Bandage • More attention, frequency • Psychosocial support	• Early detection • Skin hygiene, washing and drying • Elevation • Exercise • Footwear • Cleaning of entry lesions • Applying anti-fungal or antibiotic creams • Washing with Pot. permanganate if smelling • No scratching/ puncturing • Psychosocial support	• Early detection • Skin hygiene, washing and drying • Elevation, complete rest to the part and person • Cold application • Treating headache, pain and fever • Plenty of fluid • Avoid hot application, exercise, bandaging • Refer if no relief/ worsening • Psychosocial support

(Source; WHO MMDP, 2013)

Washing: The affected parts should be washed with soap and water twice daily at room temperature and dried carefully with a clean cotton clothes and gauze. Cleaning should be gentle, without rubbing. Special attention should be paid to the toe web spaces. Diligent washings may reduce the requirement of antibiotics and prevent progression of lymphoedema.

Figure 1.15 Skin care and washing (Training module, 2012)

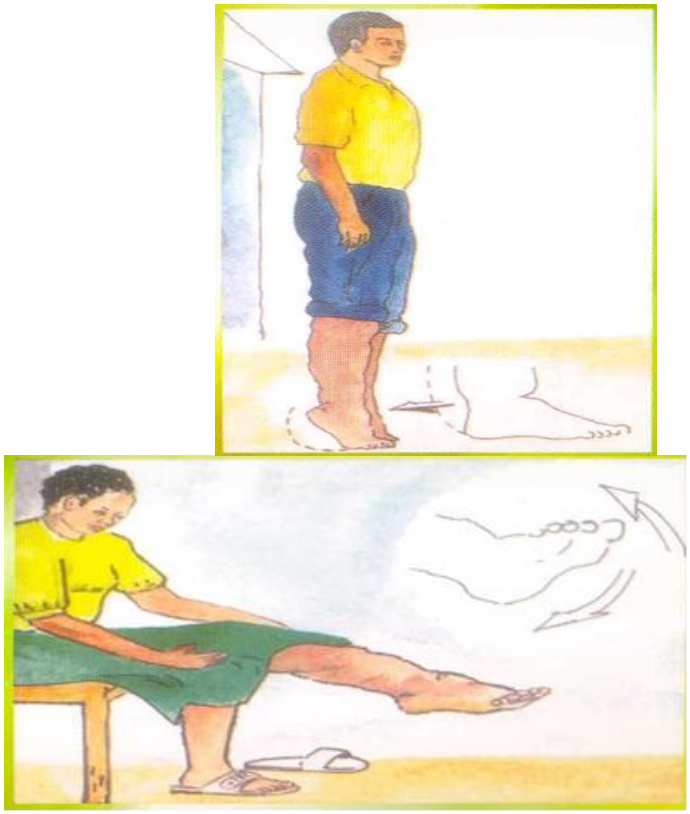
Skin care: An intact skin provides an effective barrier against infection. Wearing shoes/sandals is a strategy to protect skin. In the presence of bad odor or infection potassium permanganate or other antibiotics is added in water. Use of turpentine oil removes maggots. In case of fungal and bacterial infection appropriate ointment should be applied.

Exercise: The affected limb should be raised at night and daytime whenever possible and exercise regularly with low intensity movement of the joints. The patients should be encouraged to move as immobility worsen the condition significantly.

Simple exercises help in lymph flow. The following exercises can be carried out in any place and at any time.

- Rising up and down on toes - this exercise can be done standing or sitting.
- Flexing the foot upwards and making circular movements at the ankle joint.

Figure 1.16 Exercise (Training module, 2012)



In case of acute attack, exercise should be avoided.

Elevation: Elevation is a simple measure which lessens the suffering due to lymphoedema. It enhances lymph flow from the affected part and enables the affected person to carry out daily activities with more comfort. Elevation can be done by:

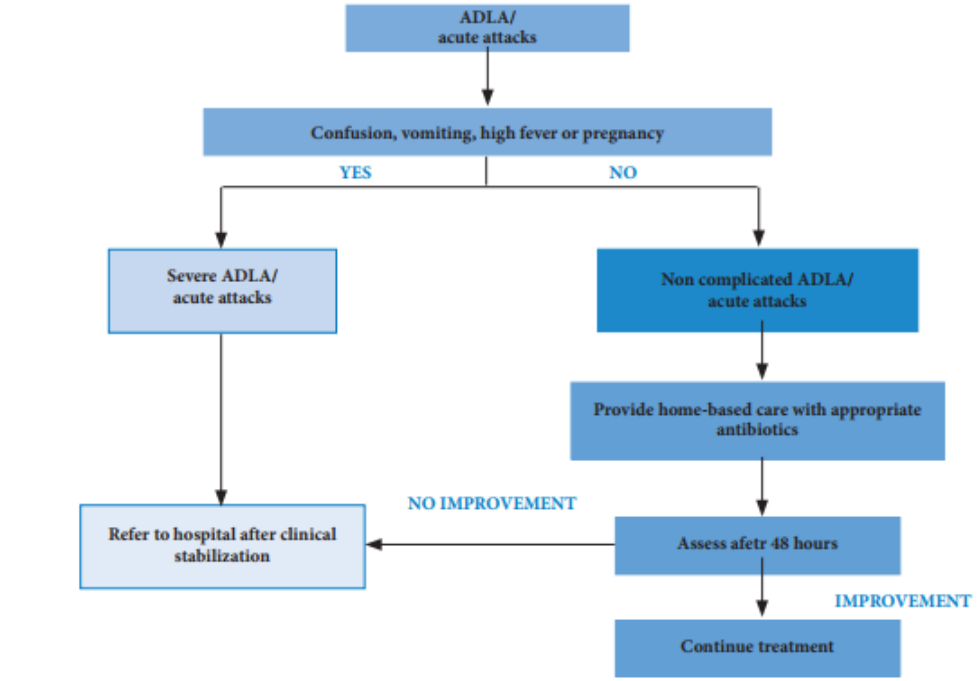
- placing a pillow under the mattress or bricks under the cot while sleeping;
- placing a pillow or a folded blanket under affected breast, arm or scrotum;
- placing the affected leg on some support at the level of the waist during cooking, playing, working, breastfeeding and so on.

Figure 1.17 Elevation (Training module, 2012)

Foot care: Suitable footwear is essential to protect, keep the foot clean and prevent entry lesions. The swelling being on the dorsal side of the foot and irregular, special modification is essential in designing suitable footwear. It is important to select the right footwear in the right size, because poorly fitted ones can cause more harm than good. Footwear should keep the feet in place while walking, and not be tight. Footwear needs to be prepared only by an experienced shoe technician. The criteria for good footwear are as follows:

- It should fit like gloves but should not be too tight or too loose.
- It should not slip at the heel and there should be plenty of space at the toes.
- It should not have heels and iron material; nails are not to be used in its manufacture.
- Upper straps should be of nylon (woven straps), 1 or 2 inches wide and adjustable (WHO-MMDP, 2013)
- It should not slip at the heel and there should be plenty of space at the toes
- It should not have heels and iron material; nails are not to be used in its manufacture.
- Upper straps should be of nylon (woven straps), 1 or 2 inches wide and adjustable (WHO-MMDP, 2013)

Figure 1.18 Flowchart of management of ADLA on Lymphoedema (Source: WHO MMDP, 2013)



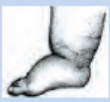
Source: Modified from *Informal consultation on preventing disability from lymphatic filariasis, WHO, Geneva, August 2006 (5). Weekly Epidemiological Record*, 2006, 40:373-383.

During acute attacks, affected persons are advised **not to:**

- exercise (it can be very painful);
- put anything which is warm or hot on the skin;
- open or slit a blister;
- cut the skin for any reason;
- bandage the leg;
- apply herbs, ashes, or anything else on the skin that has not been advised by a doctor or nurse.

A person with acute attack should be referred to the health facility if antibiotics or other measures fail to relieve the symptoms within 24 hours, or if the acute symptoms increase (Figure 1.18, WHO-MMDP, 2013)

Figure 1.19 Management of lymphoedema as per stages (Source; WHO MMDP, 2013)

Treatment	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
							
Hygiene (washing and drying)	Yes (ideally at night)	Yes (ideally at night)	Yes (ideally at night)	Yes (ideally at night)	Yes (twice a day if possible)	Yes (twice a day if possible)	Yes (twice a day if possible)
Care of entry lesions	If present	If present	If present	If present	If present	If present	If present
Exercise	Yes	Yes	Yes	Yes	If possible	If possible	If possible
Elevation	Usually not necessary	Day and night	Day and night	Day and night	Day and night	Day and night if possible	Day and night if possible
Compressive bandaging	Optional	Optional	Optional	Only when advised	Only when advised	Not advised in most cases	Not advised in most cases
Prophylactic creams	No	No	No	When necessary	Usually necessary	Always necessary	Always necessary
Prophylactic systemic antibiotics (send to doctor)	No	No	No	Usually not necessary	Usually necessary (if ADLA persists)	Always necessary	Always necessary
Plastic surgery	No	No	No	If medically indicated	If medically indicated	If medically indicated	If medically indicated

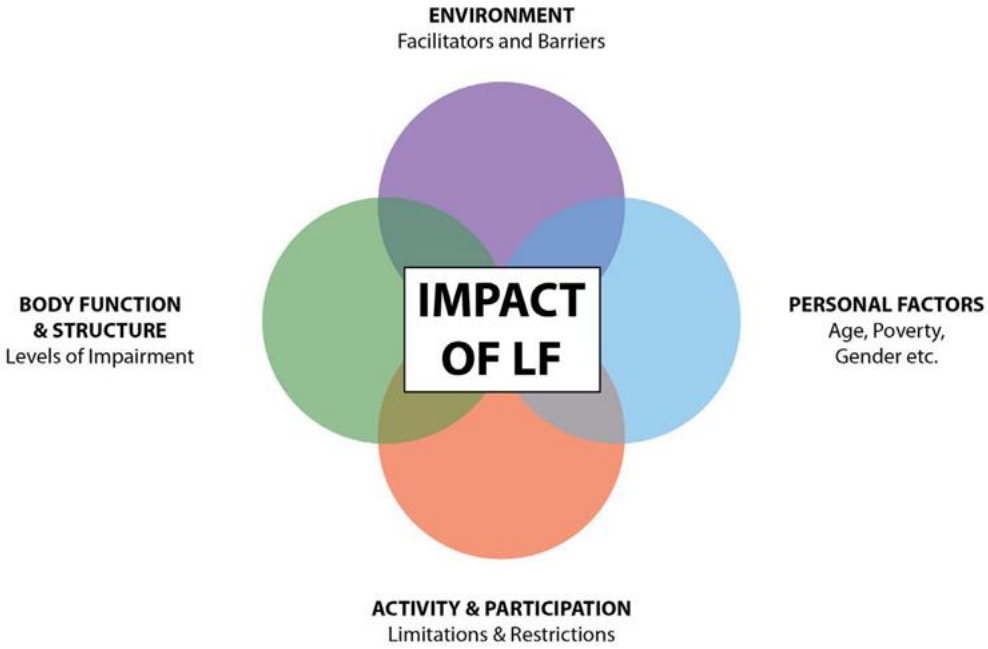
ADLA, acute dermatolymphangioadenitis

Socioeconomic burden

Lymphoedema and hydrocele lead to permanent disability. They often cause disfigurement and long term disability (WHO, 2013). Managing acute condition is a burden on patients and health system. Economic losses due to reduced productivity are also a drain on economy. It was estimataed to be responsible for losses of US$ 60-85 million per year in India (Suma TK et al, 2002; Shenoy RK et al, 2003) and US $ 38 million per year in the Philippines Weekly Epidemiological Record-WHO, 2004).

Chronic condition exerts a heavy social burden on patients. Lyphoedema specilay elephantiasis considered shameful and prevent from playing their role in society and stopping working or changing to less productive jobs. All these badly effect on quality of life. Lynn"s paper on disability demonstrated the several factors affecting the quality of life in LF patients (Zeldenryk L et al 2013).

Figure 1.20 Assessment tools in different stages of elimination



Global Programme to Eliminate Lymphatic Filariasis (GPELF)

In 1997, the World Health Assembly resolved to eliminate lymphatic filariasis as a public health problem (WHA resolution 50.29). In 2000, the GPELF was launched by WHO

Goal: Global elimination by 2020

Aim 1. *Stop the spread of infection: interrupt transmission by* ***MDA***

Aim 2. *Reduce the suffering caused by the disease:* ***morbidity management and disability prevention-MMDP***

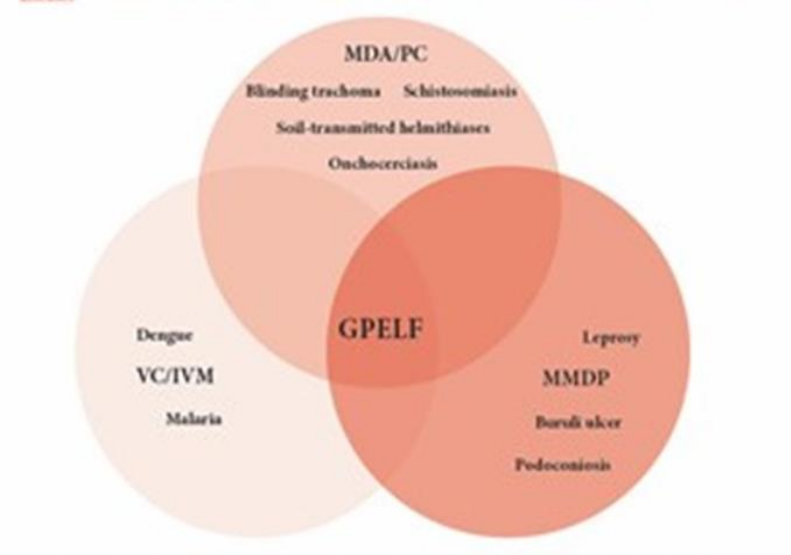
GPELF recommends MDA using a combination of medicines:

1. diethylcarbamazine (DEC) + albendazole (in countries not co-endemic for onchocerciasis)
2. ivermectin + albendazole (in countries co-endemic for onchocerciasis)

- of single-dose treatment for at least 5 years
- to all eligible individuals in the entire endemic area

LF also has the ability to link with other control strategies including MDA, vector control using insecticide treated nets (ITNs) and also for morbidity management. The following figure 1.21 highlights opportunities for integrating LF activities into programmes of other disease.

Figure 1.21 Overlapping strategies of elimination and control of NTD



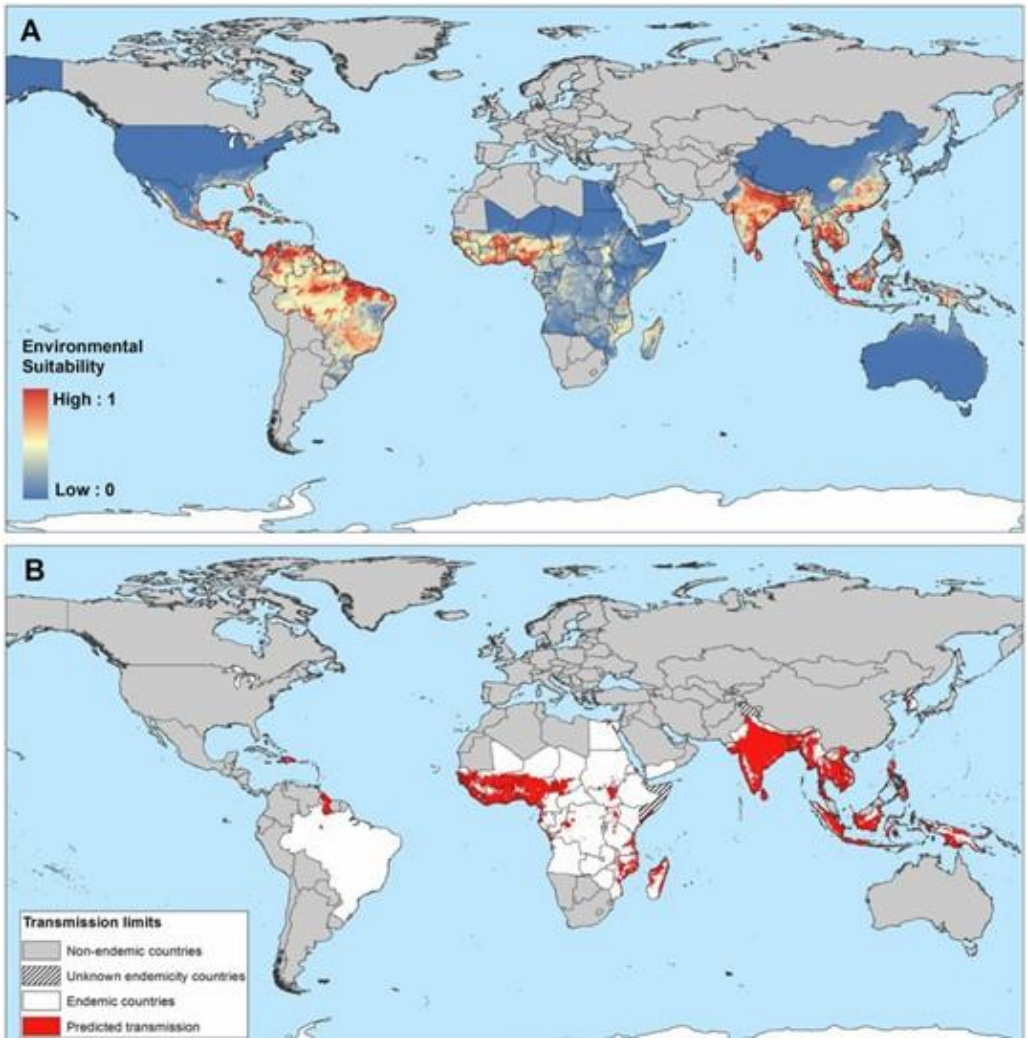
(Source: WHO-MMDP, 2013).

1.10. Achievement towards elimination of LF

LF is second leading cause of permanent disability worldwide and accounts for 2.8 million disability adjusted life years (DALY) lost (Dickson et al, 2017). WHO recommends that all LF endemic countries be part of the proposed strategy that aims to reach the elimination goal by 2020. Between the beginning of GPELF in 2000 and 2012, 59 countries have started implementing MDA, and 12 countries have successfully stopped MDA after five or more rounds with high coverage and entered the post-MDA surveillance phase (Ichimori et al, 2014). Of the remaining countries, all 14 will implement and complete LF mapping by the end of 2015. Initially GPELF's main focus was MDA implementation and achieving successes towards elimination. The MDA coverage of total population requiring MDA was 57.9% with 495.6 million persons in 40 reporting countries, in 2016 (WHO-WER, 2017). Figure 1.22 shows

region wise MDA status reported to WHO. After successful five or more rounds of MDA, Transmission Assessment Survey (TAS) was conducted. In 2016 TAS was implemented in 23 countries with an overall pass rate of 91.9%. Area wise WHO reported TAS result is shown in figure 1.23 (WHO-WER, 2017). In those countries no longer MDA is needed. On the other hand, a failed TAS means persistent transmission after MDA. American Samoa, India, Malaysia, Myanmer, Philippines and United Republic of Tanzania experienced failed TAS in 2016.

Figure 1.22 Global environmental suitability (A) and (B) limits of LF transmission

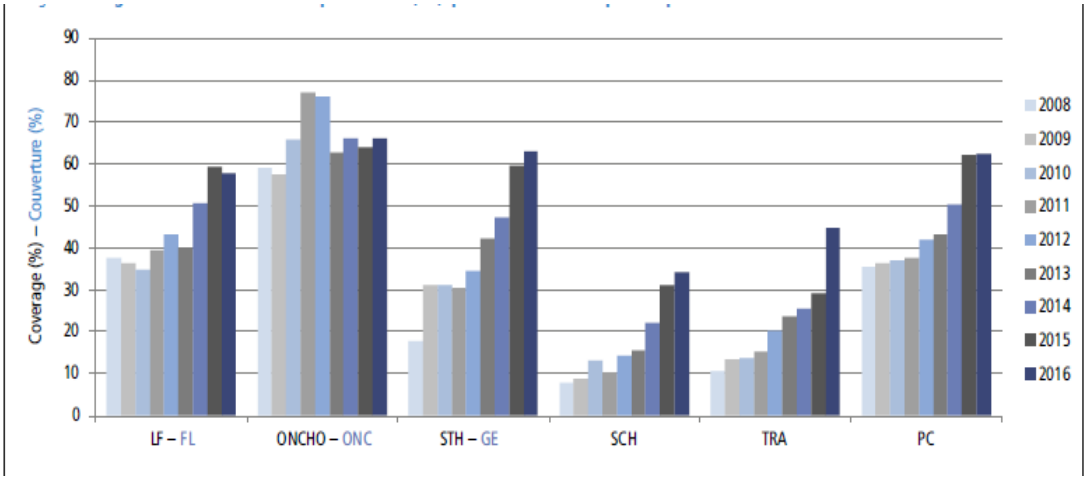


Source: Cano et al. 2014

Table 1.2 Summary of morbidity management and disability prevention data reported to WHO (Source, WHO-WER, 2017)

WHO region – Région	No. of LF endemic countries– Nbre de pays d'endémie de la FL	No. countries reporting on lymphedema patients – Nbre de pays notifiant des cas de lymphœdème	No. lymphedema patients reported – Nbre de cas de lymphœdème notifiés	No. countries reporting on hydrocele patients – Nbre de pays notifiant des cas d'hydrocèle	No. hydrocele patients reported – Nbre de cas d'hydrocèle notifiés	No countries reporting on MMDP services – Nbre de pays déclarant des services de prise en charge de la morbidité et prévention des incapacités	No countries monitoring MMDP by implementation unit*– Nbre de pays surveillant les services de prise en charge de la morbidité et prévention des incapacités au niveau des unités de mise en œuvre*
African – Afrique	34	13	71 400	13	86 235	12	7
Americas – Amériques	4	4	8 482	3	3 181	3	2
Eastern Mediterranean – Méditerranée orientale	3	2	1 306	1	18	3	2
South-East Asia – Asie du Sud-Est	9	8	956 749	7	448 567	7	8
Western Pacific – Pacifique occidental	22	18	4054	16	842	9	6
Total	**72**	**45**	**1 041 991**	**40**	**538 843**	**34**	**25**

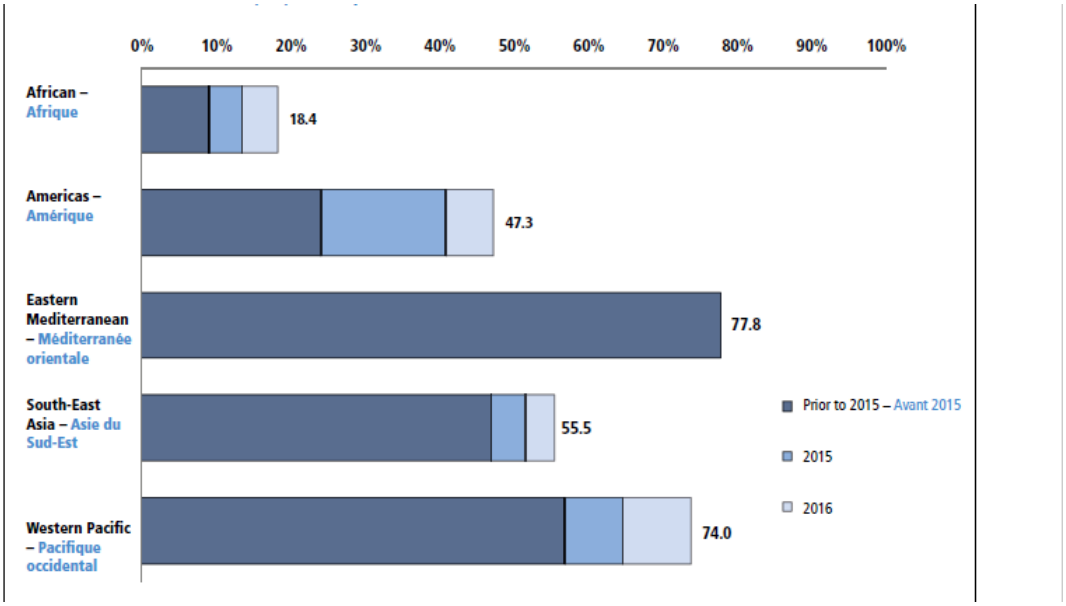
Figure 1.23 Progress of preventive chemotherapy by target disease for the 2008-2016 (WHO-WER, 2017).



In African Region, Togo is the first country to eliminate LF as a public health problem. 9 other countries in the region also passed TAS. In South East Asian region, Bangladesh has stopped MDA and joined Thailand for post MDA surveillance. Maldives and Sri Lanka continued post-validation surveillance (WHO-WER, 2017). In Eastern Mediterranean Region, Egypt and Yemen no longer require MDA and implemented and passed TAS. Two countries of Western

Pacific Region, Marshall Islands and Tonga were acknowledged for achieving elimination of LF as a public health problem (WHO-WER, 2017).

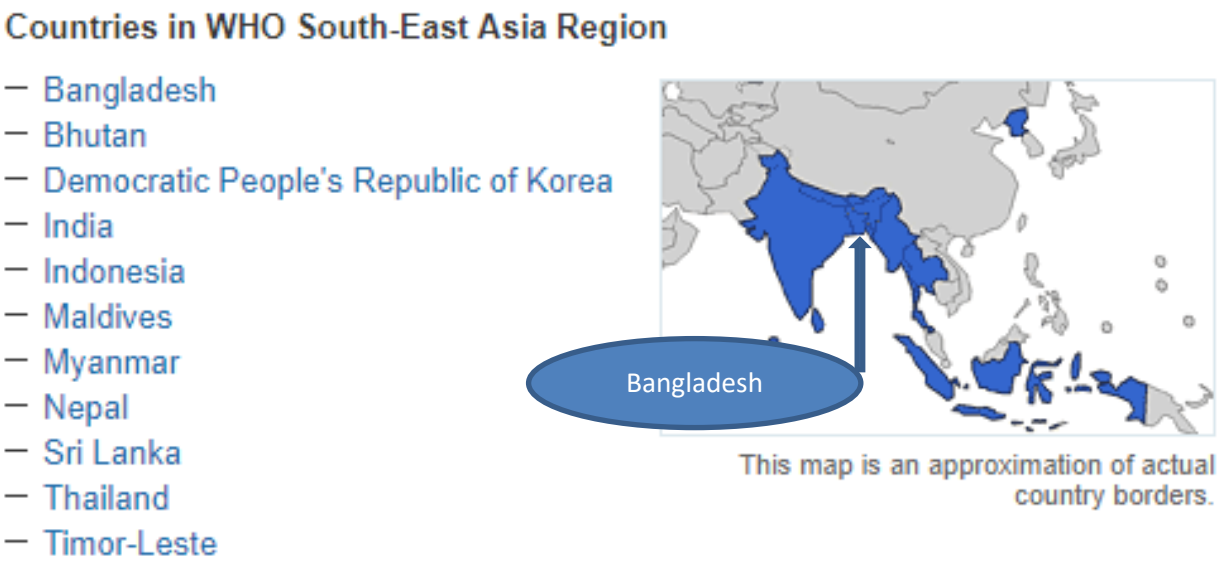
Figure 1.24 Cumulative implementation units that have completed transmission assessment survey and no longer require MDA (WHO-WER, 2017)



LF in South East Asia

The global burden of LF is highest in SEAR, representing more than half of the people at risk. The main parasite is *W. bancrofti* may be treated with MDA using the drugs albendazole in combination DEC, to clear the microfilaria in the blood of human populations. In 2015, the WHO reported that 50 countries have started to implement MDA, indicating significant progress, especially in SEAR (WHO-WER 2015). More recently, the WHO with regional partners and donors have focussed on patient care and started the scale up of MMDP. Countries are encouraged to conduct situation analyses to better establish the burden of disease and assess how to implement quality and access to care and services for LF patients (WHO, 2017; Ichimori et al, 2014, WHO 2013). This MMDP work complements the MDA work and will help to treat the lymphoedema, elephantiasis, and/or hydrocoele of affected individuals. It is also an important component of eliminating LF as a public-health problem and part of the WHO validation of elimination dossier requirements (Weil et al, 1997).

Figure 1.25 LF endemic countries in South East Asian region (WHO, 2017)

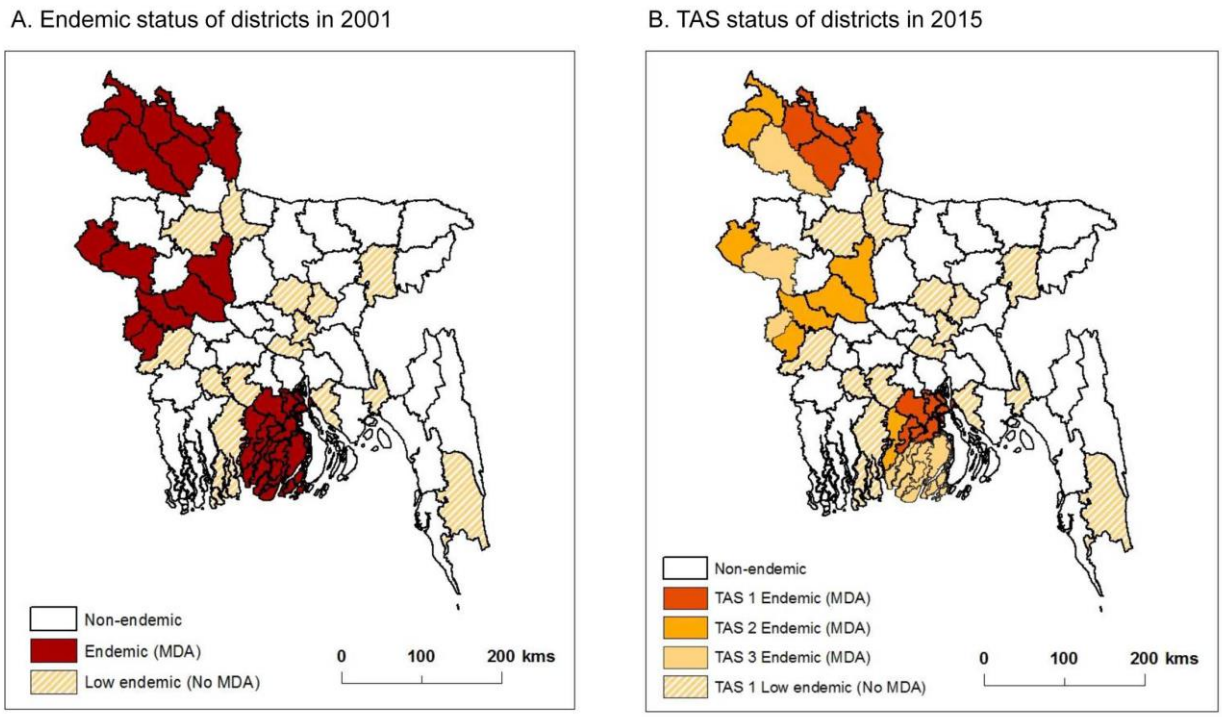


1.11 LF Elimination in Bangladesh

Bangladesh with an estimated population of 142.30 million (Census 2011), is a major LF endemic country. The burden of LF is considered to be immense with the highest rates of infection and an estimated 70 million people (approximately half the total population) were considered to be at risk of LF infection, with tens of thousands of people suffering from various forms of clinical presentation, including limb lymphoedema/elephantiasis and hydrocele (Hafiz et al, 2015).

The disease is caused by the parasite *Wuchereria bancrofti* and *Culex* mosquitoes are the main vectors for transmission (WHO, 2014, Ramaiah et al, 2014). In 2001, an assessment based on microfilaria (Mf) levels found the disease to be prevalent in 34 of the 64 districts with 19 districts eligible for mass drug administration (MDA). The remaining 15 districts were found very low endemic (according to Ag test in 2002-2004) and not eligible for MDA according to Mf survey, as Mf prevalence is below 1 (figure 1.25). The highest LF endemicity occurs in the northern region of the country where during the 1970s–1980s, and at the start of the LF Programme, estimates of microfilaria prevalence were up to 17% with disease burden 10%. Nilphamari District is considered to have the highest levels of endemicity. Figure 1.25A shows the endemic status of the districts in Bangladesh.

Figure 1.26 LF in Bangladesh at baseline and recent period.



Source: Shamsuzzaman et al, 2017.

Over the past 16 years, the LF Programme in Bangladesh has concentrated its efforts on interrupting transmission through annual MDA with the two drugs albendazole and DEC. These programmatic efforts have been very successful as measured by the TAS, following the WHO post-MDA surveillance guidelines (Figure 2.27B shows the TAS status in 2015).

However, a large number of cases with chronic clinical manifestations remain (WHO, 2011; Hafiz et al, 2012). Bangladesh was one of the first countries in the SEAR to start the elimination process with MDA to interrupt transmission in endemic areas (WHO, 2014, Ramaiah et al, 2014) and one of the first countries to begin the elimination verification process (Addiss et, al. 2007; Brady et al, 2014).

National LF Elimination Programme Management team in Bangladesh

Bangladesh LF elimination programme is led by the Director Communicable Disease Control (CDC) under Ministry of Health and Family Welfare (MOHFW) with supervision of Directorate General of Health Services. The LF Program Manager is responsible for implementation of activities related to MDA and MMDP activities. In LF programme team there are three medical officers, three consultants, two /three lab technologists, one accountant, two admin staff, three supporting staff has been working for implementation and monitoring of program.

International partners provide funding and technical assistance for activities related to training, monitoring, sentinel site surveys and dossier development. At the community level, CHWs under supervision of Upazila Health Manager are working for MDA implementation and monitoring, MMDP. They conduct home-based morbidity control and provide health care through community clinic. In addition, the Japanese organisation, JICA, provide assistance through volunteers who are working in highly endemic district for morbidity control. They helped to conducted a patient searching survey in 2005 to find out clinical cases in the most endemic areas of the northern region of the country.

Along with Government of Bangladesh, international partners including CNTD-LSTM, UK, GPELF, WHO, World bank, JICA, UASID through RTI have been providing technical and financial support for LF elimination programme.

1.12 Rationale for the study

Morbidity control is one of the two main pillars of the GPELF and at the 6th Global GPELF meeting in 2010, morbidity control was identified as a research priority (WHO, 2000, 2012, 2017, Bockarie et. al, 2002). The National LF Elimination Programme in Bangladesh has started to address issues related to LF morbidity control on a larger scale to reduce the suffering of the huge number of patients (Shamsuzzaman et al, 2017). However, until recently very little was known about the burden of disease following MDA, how morbidity was being managed, the most appropriate methods to treat disabled communities, and how local health workers can facilitate the best care for patients.

To design the morbidity control services a mapping survey and knowledge, attitude and practice (KAP) study on morbidity management practices at community level may play

significant role. Mapping is very important to provide policy direction for advocacy and program planning on morbidity (Mathieu et al., 2008). Understanding the range of different interventions for home-based morbidity control program of lymphoedema will provide the information on the most appropriate approach for morbidity control in Bangladesh. Related studies may also help to demonstrate how to scale-up morbidity control program, how to target high risk groups and specific techniques to help decrease physical and emotional burden of the disease and improve quality of life.

In this context, this research aimed to assess the distribution and severity of disease, specifically examining existing data and assessing communities after 5 rounds of MDA in a highly endemic district. Further, it aimed to determine patient's and community health workers (CHW) ' KAP of LF and morbidity management. The results of the study are expected to help plan morbidity control of LF patients and will provide policy direction for advocacy and programme planning in Bangladesh. The aim and objectives of the study were discussed with National Programme Manager, and were aligned with local control aims, as well as those set out internationally by GPELF.

1.13 Overall Aims and Objectives

The overall aim of the study was to investigate LF distribution and MMDP related activities in Bangladesh. The specific objectives related to the research chapters include

1. To examine the historical distribution of LF clinical case data in an endemic district before the scale up of MDA activities
2. To determine the number of LF clinical cases in an endemic district after a decade of MDA activities
3. To determine the KAP of LF and morbidity management among community members
4. To assess the workload, experiences and perspective of CHWs before the scale up of MMDP activities

1.14 Thesis layout

Chapter 1. Provides an overview of LF, GPELF, the SEAR, Bangladesh as well as the rational for the thesis topic, and outlines the overall aim and specific objectives and thesis layout.

Chapter 2. Provides background to the current literature including the global distribution, GPELF achievements, the life cycle, diagnostic tools, pathogenesis, clinical symptoms, MMDP, socioeconomic burden, LF in SEAR and Bangladesh

Chapter 3. Examines historical data on LF clinical cases in the endemic district of Nilphamari where data on the age, sex, sub-districts level (union, upazila) and clinical condition (lymphoedema, hydrocoele, ADLAs) was available

Chapter 4. Determines the current estimate of clinical disease through a cluster survey in Nilphamari district, with data collected on age, sex, sub-districts level (village, union, upazila) and clinical condition (lymphoedema, hydrocoele, ADLAs).

Chapter 5. Determines the KAP of community members and people affected by LF and through a field survey in Nilphamari districts which included socio-demographic information, and topics including knowledge of filariasis, knowledge of treatment and prevention, opinions on transmission and elimination and clinical management and impact.

Chapter 6. Assesses the CHW workload, experiences and perspectives through a field survey in Nilphamari district which included information on demographic and workload characteristics, knowledge of disease, prevention and morbidity management, opinions of training, morbidity management and programmatic activities.

Chapter 7. Provides a general discussion and set of recommendation related to the research chapters that may be used by the National Programme or researchers interested in conducting research in Bangladesh on LF morbidity in the future

Chapter Two

Distribution of lymphatic filariasis morbidity cases in Nilphamari district before scale up of MDA

2.1 Introduction

Lymphatic Filariasis is one of the major cause of disability in northern districts of Bangladesh. At the very beginning of the LF programme in 1970-80s, estimates of Mf prevalence were up to 17% with disease burden 10% (Wolfe et al. 1972; Barry et al. 1971). Nilphamari district is considered to have one of the highest levels of endemicity. There was an effective effort to estimates LF cases by the Japanese International Cooperation (JICA) volunteers in collaboration with the LF programme in 2005. A house to house clinical case identification survey conducted and found thousands of cases (unpublished data) who required care. Understanding the burden of disease is important as it may help MDA compliance and raise awareness of community burden. The data collected by JICA provides an opportunity to examine the pre-MDA distribution of clinical cases.

The main aim of this chapter was to examine the historical distribution of LF clinical cases in Nilphamari to better understand the burden of disease before the scale-up of MDA.

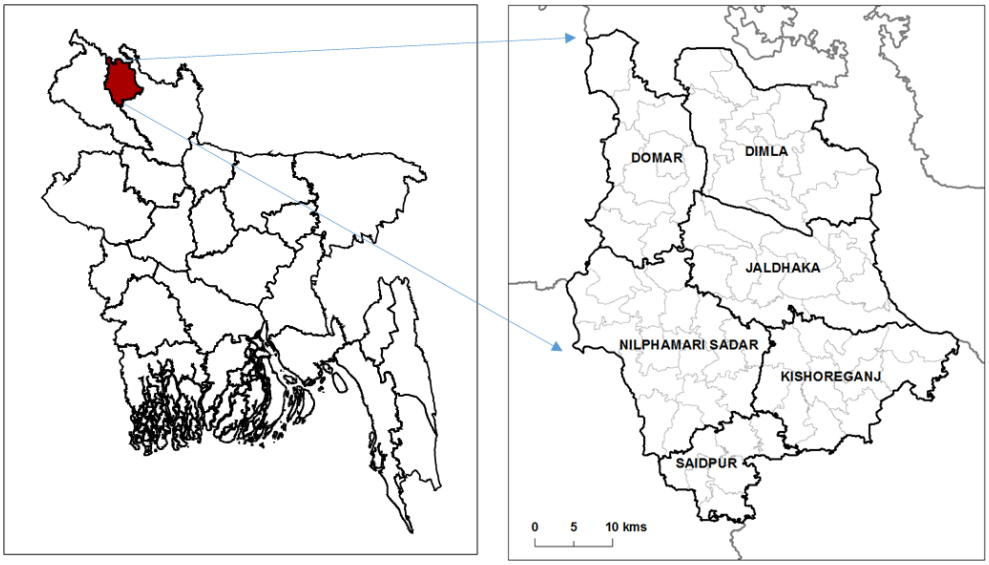
2.2. Methods

2.2.1 Study area

The JICA survey was conducted in Nilphamari District, which is historically known as highly endemic district. The Japanese overseas volunteers worked in this area and they collected data from the community under the guidance of National LF elimination programme. This district is approximately 1550 square kilometres in size, and bordered by India in north and the Bangladesh districts of Rangpur, Lalmonirhat, Dinajpur and Panchagarh in the east, west and south. The total population of the district is approximately 1.8 million with a growth rate of 1.53 %. The district consists of 6 upazilas, 61 unions, and 361 villages. Upazilas are administrative and geographical sub-units of a district, which are also divided into unions

comprising approximately nine wards or villages. In Nilphamari, the six upazilas include Dimla, Domar, Jaldhaka, Kishoregonj, Sadar and Saidpur (Bangladesh Bureau of Statistics, 2010).

Figure 2.1 Nilphamari district and upazilas in the district.



2.2.2 Clinical assessment

The data recorded on patients found in the community included, their age and sex, location (upazila) and a clinical assessment was conducted to determine the presence of a hydrocoele in males, lymphoedema of the limbs, breast and labial in females, and episodes of ADLAs, as per questionnaire. The standard form that the Bangladesh LF programme uses to collect data is shown in Figure 2.2.

2.2.3 Data analysis and mapping

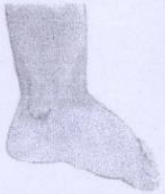
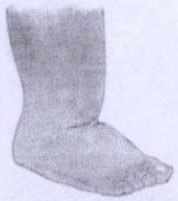
All data were entered Microsoft Excel Version 12.3.6 (Microsoft Corp., Redmond, VA, USA) and analysed in IBM SPSS Statistics 22 IBM Corp., Armonk, NY, USA). Cross tabulation, chi square tests and independent samples t-test using a 5% significance level were used to determine the relationship between clinical disease and age, sex, and location.

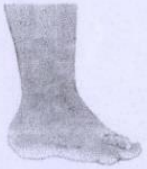
ফাইলেরিয়াসিস নির্মূল কর্মসূচী, স্বাস্থ্য অধিদপ্তর, মহাখালী, ঢাকা-১২১২।

Report Form for Patient of Lymphatic Filariasis

Date: _____

Union: _____ Ward: _____ Name of Health worker: _____ (HI / AHI / HA / FPI / FWA)

আক্রান্ত জায়গা	Leg **A** (পা-এ)		Leg **B** (পা-বি)		Leg **C** (পা-সি)		Arm**D** (হাত-ডি)		Breast **E** (স্তন-ই)	
	 সামান্য ফোলা		 স্থায়ী ভাবে ফোলা এবং সামান্য ঘা		 স্থায়ী ভাবে বেশি ফোলা, ঘা আক্রান্ত অংগ শক্ত হয়ে যাওয়া		 হাত ফোলা		 স্তন ফোলা	
বাম বা ডান	বাম	ডান	বাম	ডান	বাম	ডান	বাম	ডান	বাম	ডান
(✓) টিক চিহ্ন দিন										

আক্রান্ত অংগের অবস্থা	Acute Attack **F**		Hydrocele **G**	
	 আক্রান্ত অংগ ব্যথা এবং ত্বক লাল হয়		 অন্ডকোষ ফোলা	
ব্যথা আছে কি?	হ্যাঁ	না	হ্যাঁ	না
(✓) টিক চিহ্ন দিন				

Patient Information

Name:	
House Holder's Name	
G.R. No.	
Village Name	
Age and Sex	Years Old Male / Female

Figure 2.2 Lymphoedema stages with translation into local language

2.3 Results

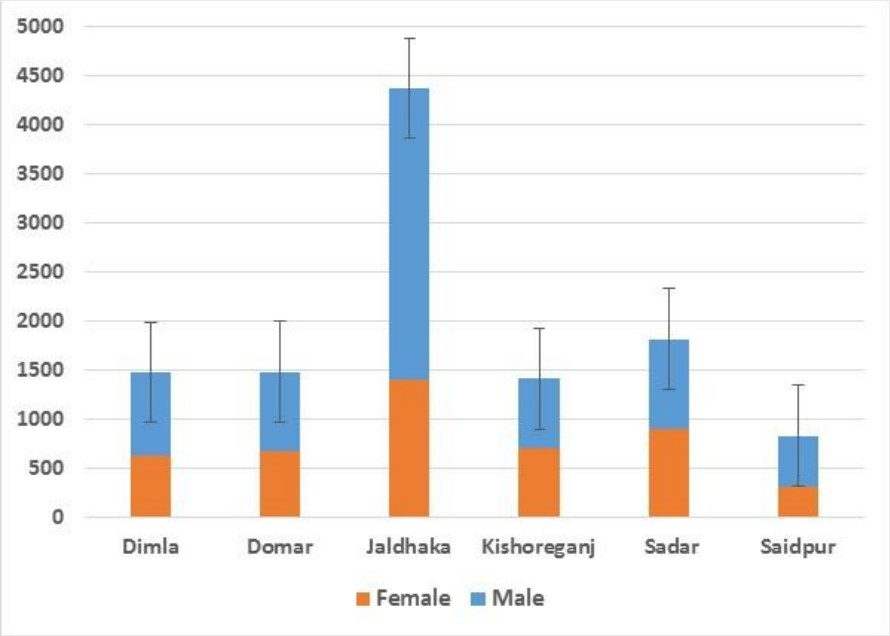
2.3.1 Summary of number of cases and prevalence by upazila, union and gender

In total there are 6 upazilas with 61 unions, 42 wards and 361 villages where clinical cases of LF were found (BBS-2011). A summary of the number of cases by each upazila, union, sex and population of per 1000 are listed in Table 2.1. The overall number of cases of clinical LF was 11370 (Females-6773, males- 4596) and prevalence across the total population was 0.8% or 7.8 per 1000 people.

The number of LF cases are highest in Jhaldkaka and lowest in Saidpur (Figure 2.3). Prevalence of LF cases were significantly higher in Jhaldhaka and lowest in Sadar. Jhaldhaka and Saidpur prevalence is significantly higher than other upazila showing in Figure 3.3. Total cases are significantly higher in Jhaldhaka Upazila in compared to other upazila. Male prevalence is even higher than females in this upazila as shown in Figure 2.3 A and B.

Figure 2.3 Summary data by upazila

A. Total number of cases by gender and upazila



B. Prevalence per 1000 people by Upazila

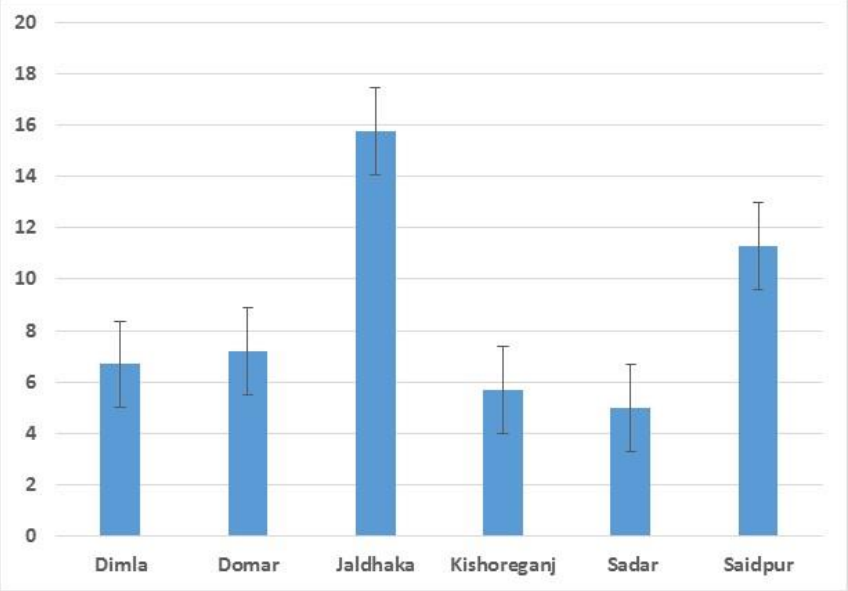


Table 2.1 Unions and number of clinical cases and infections in Nilphamari district

Upazila	Union	Male	Female	Total No.	Total Population	per 1000
Dimla	Bala Para	42	81	123	26863	4.58
	Dimla	117	126	243	38403	6.33
	Gayabari	86	113	199	18202	10.93
	Jhunagachh Chapani	81	52	133	25146	5.29
	Khalisa Chapani	62	106	168	24549	6.84
	Khoga Kharibari	78	119	197	17916	11
	Naotara	83	91	174	27564	6.31
	Paschim Chhatnai	25	66	91	18303	4.97
	Purba Chhatnai	12	39	51	12366	4.12
	Tepa Kharibari	38	57	95	14663	6.48
Dimla Total		**624**	**850**	**1474**	**223975**	**6.68**
Domar	Bamunia	61	99	160	13643	11.73
	Bhogdabari	65	226	291	31513	9.23
	Boragari	35	44	79	24794	3.19
	Domar	94	59	153	33142	4.62
	Gomnati	78	39	117	21419	5.46
	Harinchara	64	54	118	14457	8.16
	Jorabari	58	72	130	19842	6.55
	Ketkibari	51	62	113	15058	7.5
	Panga Matukpur	92	81	173	18938	9.14
	Sonaroy	71	71	142	22893	6.2
Domar Total		**669**	**807**	**1476**	**215699**	**7.17**
Jaldhaka	Balagram	202	366	568	23229	24.45
	Daoabari	39	64	103	10025	10.27
	Dharmapal	125	164	289	19729	14.65
	Golmunda	85	105	190	21631	8.78
	Golna	72	240	312	22029	14.16
	Jaldhaka	142	335	477	31669	15.06
	Kaimari	179	558	737	34824	21.16
	Kanthali	118	366	484	19223	25.18
	Khutamara	83	74	157	28776	5.46
	Mirganj	95	211	306	22614	13.53
	Saulmari	166	326	492	20245	24.3
	Shimulbari	86	167	253	20742	12.2
Jaldhaka Total		**1392**	**2976**	**4368**	**274736**	**15.77**
Kishoreganj	Bahagili	60	48	108	23290	4.64
	Barabhita	63	45	108	22889	4.72
	Chandkhana	85	117	202	26142	7.73

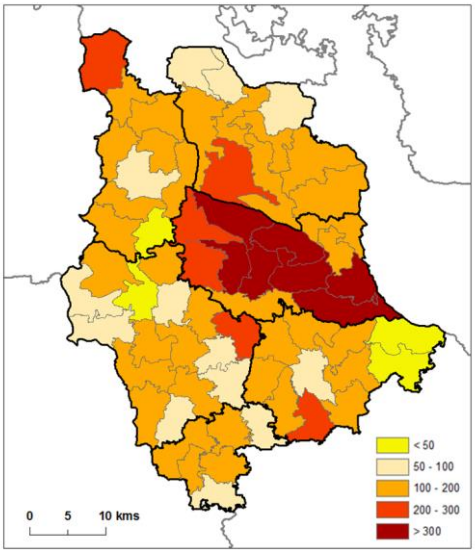
	Garagram	106	84	190	28012	6.78
	Kishoreganj	55	39	94	35167	2.67
	Magura	72	95	167	35360	4.72
	Nitai	95	93	188	25333	7.42
	Putimari	62	101	163	31098	5.24
	Ranachandi	107	79	186	25901	7.18
Kishoreganj Total		**705**	**701**	**1406**	**253192**	**5.68**
Sadar	Chaora Bargachha	45	74	119	21688	5.49
	Chapra Saramjani	51	40	91	22905	3.97
	Charaikhola	96	54	150	27300	5.49
	Gorgram	43	53	96	24011	4
	Itakhola	106	67	173	23231	7.45
	Kachukata	137	152	289	21915	13.19
	Khokshabari	12	49	61	20885	2.92
	Kunda Pukur	58	95	153	27224	5.62
	Lakshmi Chap	50	65	115	16351	7.03
	Palasbari	39	5	44	18090	2.43
	Panch Pukur	38	31	69	19712	3.5
	Paurashava	65	53	118	40084	2.94
	Ramnagar	70	58	128	20483	6.25
	Sangalshi	30	21	51	18219	2.8
	Sonaroy	40	62	102	25392	4.02
	Tupamari	19	40	59	24389	2.42
Sadar Total		**893**	**917**	**1810**	**371879**	**4.97**
Saidpur	Bangalipur	27	43	70	16791	4.17
	Bothlagari	61	92	153	30537	5.01
	Kamar Pukur	59	136	195	22406	8.7
	Khata Madhupur	38	49	87	19427	4.48
	Kushiram Belpukur	47	92	139	25855	5.38
	Paurosova	74	109	183	4584	39.92
Saidpur Total		**306**	**521**	**827**	**119600**	**11.28**
Grand total		**4596**	**6774**	**11370**	**1459081**	**7.79**

2.3.2 Maps of the number of cases and prevalence by upazila and union

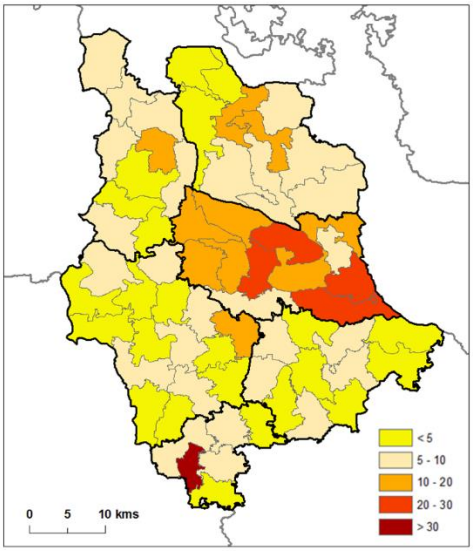
The locations, number and prevalence of the upazilas and unions are mapped in Figure 2.4. the map A of upazilas shows higher number of cases are in Jhaldhaka upazila which is similar to the prevalence of map B which shows prevalence per 1000 population. Highest prevalence is in Saidpur Upazila paurosova is 39.92, seems very unusual, may be related to high density of population in Paurosova area. Union wise prevalence shows Kanthali (25.18), Saulmari (24.3), Balagram (24.45), Dharmapal (14.65) have higher prevalence per 1000 population.

Figure 2.4 Maps of overall clinical cases and prevalence per 1000 people by union

1. Case numbers



B. Prevalence per 1000



2.3.3 Summary of clinical conditions

Lymphoedema of the leg and hydrocele were the most common condition with 5453 individuals affected by lymphoedema and 5359 affected by hydrocele. Only a small percentage (n=641; 5.6%) of these individuals had both legs affected. The next most common condition was found to be lymphoedema of the breast (n=320; 2.8%). In total 105 men had

a combination of leg lymphoedema and hydrocoele (0.9 %). There were differences between males and females and the conditions they were affected by, with females accounting for around three quarters of leg and arm lymphoedema and the most of breast lymphoedema as shown in Table 2.2. There are 148 women reported hydrocele, which could be female genitalia or miscoding, but not included in analysis.

Table 2.2 The parts of the body affected by clinical conditions stratified by sex.

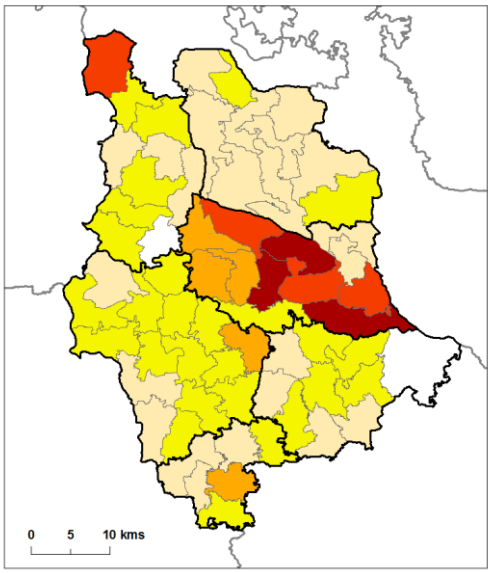
Area of body affected	Number of cases and percentage of total pre-condition				
	Males	(%)	Females	(%)	Overall
Leg lymphoedema	1402	25.7	4051	75.3	5453
Hydrocele	5359	100	….		5359
Arm lymphoedema	59	29.6	140	70.6	199
Breast lymphoedema	22	6.9	298	93.1	320
Leg lymphoedema/hydrocele	105	100			105

2.3.4 Maps of clinical case numbers and prevalence by the specific clinical condition

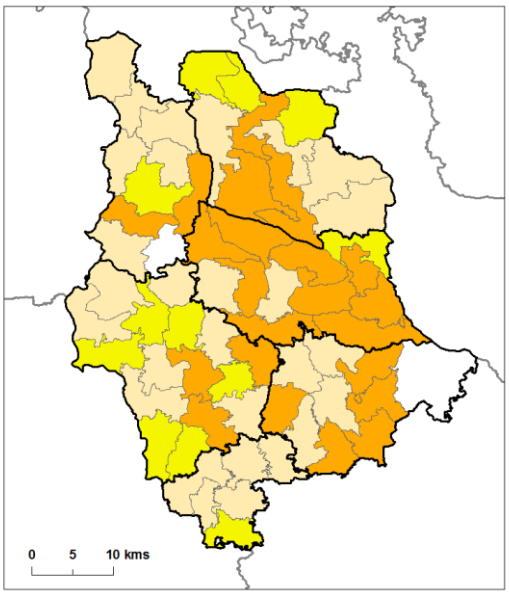
The geographical distribution of leg, arm, breast lymphoedema and hydrocoele cases is shown in Figure 2.5A-D. In total, every condition was reported in about half of the 62 unions (51.6%). High concentration of hydrocele cases were found in hotspot area (dark red) in Jaldhaka and part of Saidpur upazila Figure 2.5 A. This differs to the lymphoedema, which are more spread out and higher proportion of diseases were found in more upazilas including Jaldhaka, Kishorgonj, Nilphamary Sadar and Dimla. For the other conditions, the arm lymphoedema, even though in lower proportion has almost similar distribution of leg lymphoedema. Distribution of breast lymphoedema is in focused area of Jaldhaka district.

Figure 2.5 Village location of LF patients with clinical diseases

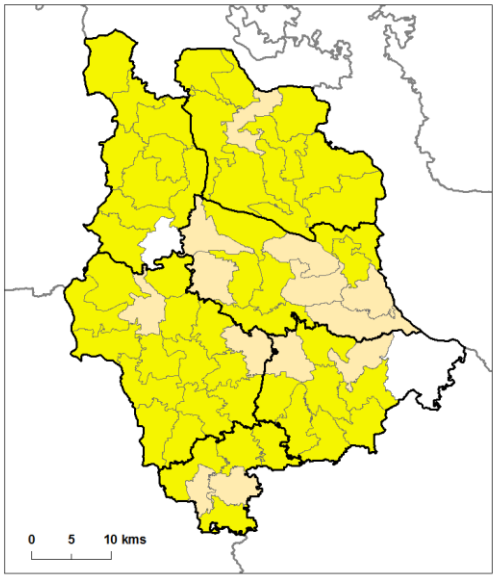
A. Hydroceole (males only)



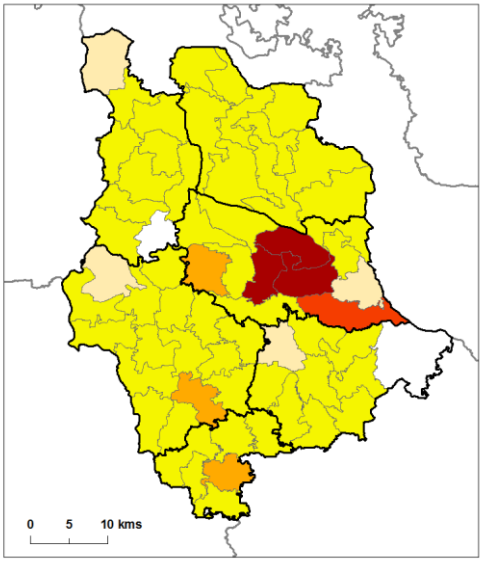
B. Leg lymphoedema



C. **Arm lymphoedema**



D. Breast lymphoedema



Increasing depth of colour-increase concentration of cases

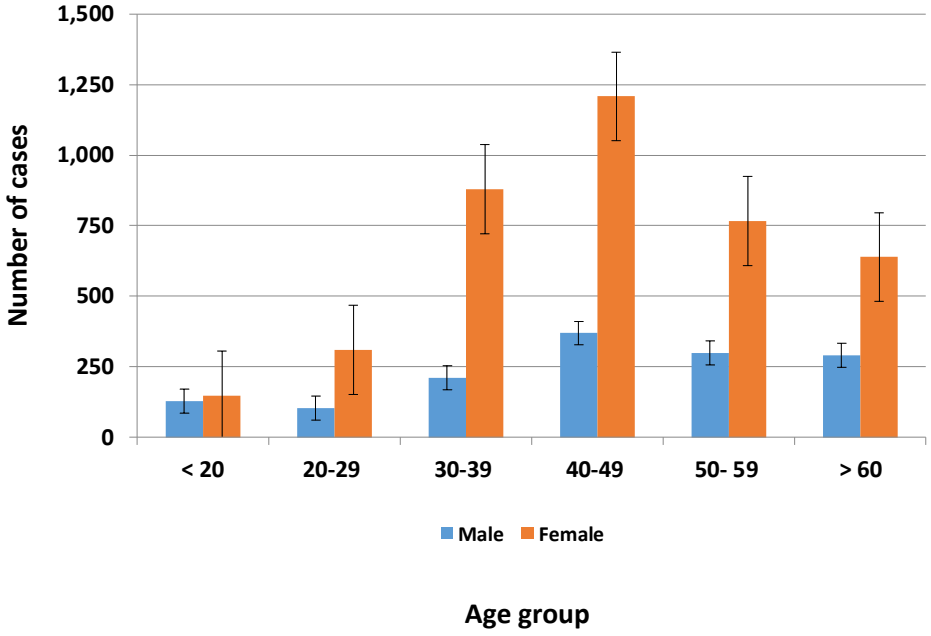
Overall, the average age group of the individuals with lymphoedema is 40-49 years (%) was significantly higher than other age group. The number of cases and age-specific prevalence of LF disease increased with age (Table 2.3) (Figure 2.6). This increasing trend was also evident for leg lymphoedema and hydrocoele cases when examined separately as shown in table 3.3 and for age-specific prevalence as shown in figures 2.6 A and B. Overall average age was 40 years. Average age is highest in Dimla (44.5 years) and lowest in Jhaldhaka (37.6 years). Lymphoedema cases are more prevalent in females in increasing age. On the other hand, hydrocele is more common in 30-49 years age groups which is most productive period of life (Figure 2.6 B).

Table 2.3 Age and sex distribution of lymphoedema cases

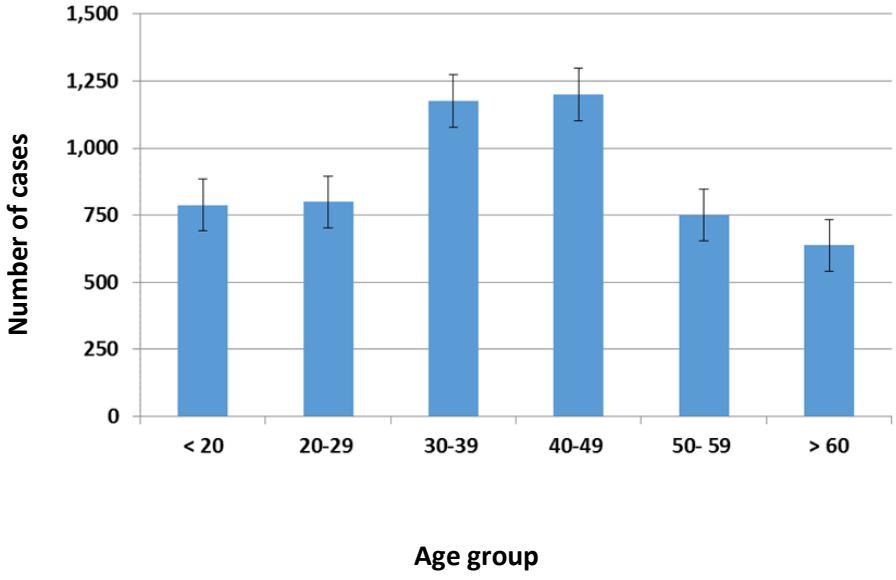
Age group (years)	Number of cases				
	Male	(%)	Female	(%)	Overall
10-19	129	46.6	148	53,4	277
20-29	103	20.1	310	79.9	513
30-39	210	19,3	879	80.7	1089
40-49	369	23.4	1208	76.6	1577
50-59	298	28.0	767	72.0	1065
≥60	290	31.4	634	68.6	924
Total	**1402**		**4051**		**5453**

Figure 2.6 Lymphoedema and hydrocele case by age group.

A. Lymphoedema



B. Hydrocele

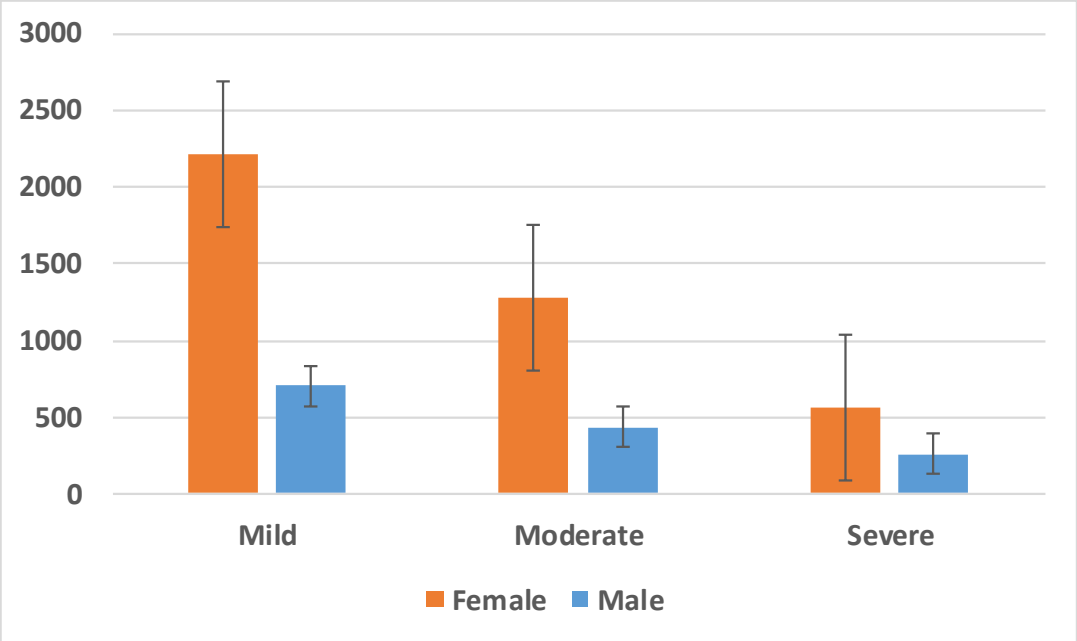


2.3.5 Severity of leg lymphoedema

A total of 2915 individual (Male-24.2% Female-75.8%) were found to have mild lymphoedema of the legs, 1718 individuals (Male-25.3%, Female-74.6%) had moderate and 820 individuals (Male-31.7%, Female-68.2%) had severe stage (Figure 2.7). For the individuals with bilateral lymphoedema, the highest severity was recorded and included in the analysis. As shown in figure 2.7 about a half of population had mild stage (53.5%), about one third had moderate (31.5%) and 15% of total had severe stage of diseases.

Similar descending trend of severity of diseases were found in both male and females. A total of mild cases was higher than severe cases by 2095 in number. Number of female cases were higher than male in all three groups. Females had significantly higher rates of disease in mild and moderate group but not in severe group than males as demonstrated in figure 2.7.

Figure 2.7 Number of leg lymphoedema cases by severity and gender



2.3.6 Acute Dermatolymphangioadenitis attacks (ADLA)

The frequency of ADLA increased with severity of Lymphoedema on all groups. As shown in figure 2.8 and figure 2.9. in female's frequency of ADLA with mild lymphoedema had -39.97%, moderate had 44.53% and severe had 45.61%. While male with lymphoedema had ADLA frequency 52.35% in mild, 59.02% in moderate and 64.39 % in severe. Male had a higher proportion of ADLA frequency. About half of male (52.53%) and female (39.97%) with lymphoedema had ADLA in mild cases. However, severe cases had higher proportion of ADLA both in male (64.95%) and female (45.61%).

Figure 2.8 Proportion of ADLA by severity of diseases-female

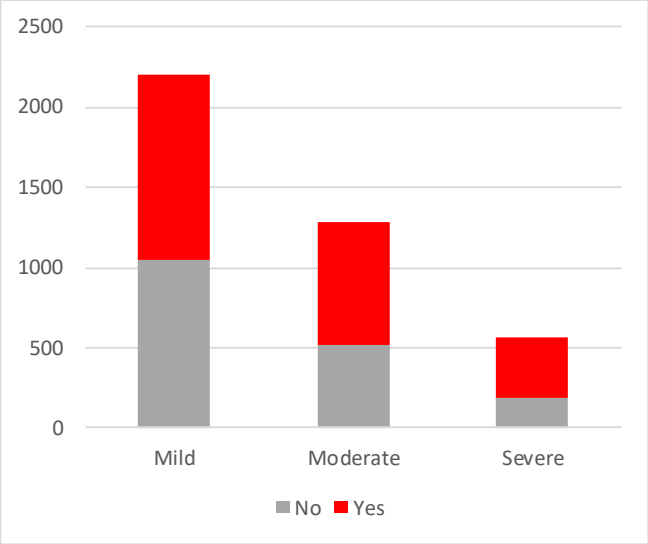
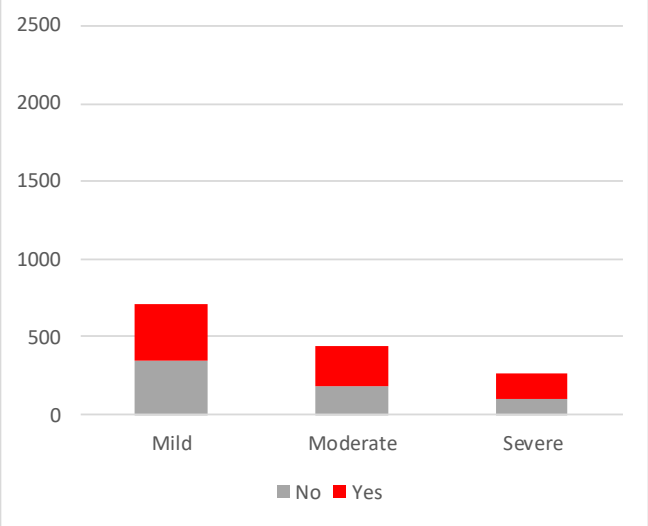


Figure 2.9 Proportion of ADLA by severity of diseases-male



2.4 Discussion

Overall prevalence in Nilphamari district is high which has been shown in other study (Aslam et al 1971). Prevalence is variable across the district, high in Jhaldhaka upazila, might be related to demography of Jhaldhaka, mosquito, for example, it could be related to poverty and availability of mosquito breeding sites. Like many other endemic area, hydrocele and lymphoedema were found to be the most common disability (WHO, 2013). Females were more commonly affected by lymphoedema and males were commonly affected by hydroceles, which is same as demonstrated by this research project (Hafiz I et al, 2015).

This data shows about 80% of affected population had mild and moderate disease. Therefore, most of the people affected will mainly need home-based management (WHO-MMDP, 2013). Remaining 15% of them are severe stage, who will require more intensive or specialised care. This severe group also has higher chance of ADLA. They need special treatment and referral for wound care. The National LF programme will need to establish a sustainable system of management for this group (Addiss et al, 2010).

MMDP needs to consider the gender differences for targeting the programme. High prevalence of hydrocele was found to be quite localized. Therefore, hospitals and surgical teams can be trained in the areas for hydrocele surgery. As lymphoedema was more widespread the programme will need a different strategy. Mainstreaming of services into existing health system would be a sustainable option considering the recent stage of programme.

Several studies showed MDA has effect on clinical condition (Ramaiah et al, 2014). For male's hydrocele incidence may be reduced due to hydrocele camp organised by the national programme and private hospital in Saidpur. For remaining hydrocele condition hydrocele surgery camp, training of local hospitals and surgeon for hot spot area and to ensure quality assurance would be appropriate (Addiss et al, 2010; Dickson, et al, 2017). After stopping MDA it is now prudent for National programme to focus on remaining morbidity.

The disabilities are high spread in community which has physical, socioeconomic and mental health effect (Ramaiah et al, 2014). This study shows males and females are affected differently by their lymphoedema. Age group mostly affected was found to be in midlife, who are the productive and active part of their life. These chronic conditions have negative impact on family wealth**.** It is also important to consider care giver and potentially they stop work to look after family members.

2.5 Conclusion

Overall the baseline study found a heavy burden of disease in one of the most endemic districts in the northern part of the country. This provided key information to the LF programme and may have helped to plan the current morbidity management activities. It also helped to understand the proposition of diseases i.e how many hydrocele or lymphoedema to hand or breast – as well as information on the severity of disease. Hydrocele was the significant burden with men affected, mainly in their most productive years of their lives, which has economic implications for them and their families. However, the advantage for men with hydrocele is that it can be corrected with surgery. In contrast, women were more affected by lymphoedema which has important implication in the long-term as they will be affected by these conditions for decades. This information also indicates where the programme should target the most social mobilisation to ensure that everyone take MDA and receives treatment.

Chapter Three

Cluster survey of lymphatic filariasis prevalence in Nilphamari District after a decade of mass drug adminsitration

(Content of this chapter has been published in Trans. R. Soc. Trop. Med. Hyg. ;109 in 2015)

3.1 Introduction

In Bangladesh, the highest LF endemicity occurs in the northern region of the country where during the 1970-80s, and at the start of the LF programme, estimates of Mf prevalence were up to 17% with disease burden 10% (Wolfe et al. 1972; Barry et al. 1971). Nilphamari District is considered to have the highest levels of endemicity. A house to house clinical case identification survey conducted in 2005 by the Japanese International Cooperation (JICA) volunteers in collaboration with the LF programme (unpublished data), estimated the prevalence of clinical cases to range from 5 to 30 cases per 1000 population by union, which is the smallest local government administrative unit and presented in figure 3.1.

Over the past 15 years, the LF programme in Bangladesh has concentrated its efforts on interrupting transmission through annual MDA with the two drugs albendazole and DEC (Ministry of Health and Family Welfare, Government of Bangladesh, 2010) These programmatic efforts have been very successful as measured by the TAS, following the guidelines by the WHO (WHO 2011a). Many districts are now considered to have interrupted LF transmission with few or no positive infections found among school aged children aged 6 to 7 years old. However, a large number of cases with chronic clinical manifestations remain (WHO 2011a; Hafiz et al. 2015). The National LF Elimination Programme has recently started to scale up activities related to morbidity.

3.2. Methods

3.2.1 Survey area

Survey area is Nilphamari district as described in Chapter two. The district has 6 Upazilas, 61 unions and 361 villages.The district consists of 6 upazilas, 61 unions, and 361 villages. Upazilas are administrative and geographical sub-units of a district, which are also divided

into unions comprising approximately nine wards or villages. In Nilphamari, the six upazilas include Dimla, Domar, Jaldhaka, Kishoregonj, Sadar and Saidpur (Bangladesh Bureau of Statistics, 2010). Since the beginning of the LF programme, the district has been prioritised for elimination and received 12 rounds of MDA, once in a year between 2002 and 2013 with coverage levels exceeding the standard WHO requirements of more than 65% of the total population. Recently transmission has been assessed and now considered to be interrupted as measured by TAS, with no positive infections found among the surveyed school aged children.

3.2.2 Survey design

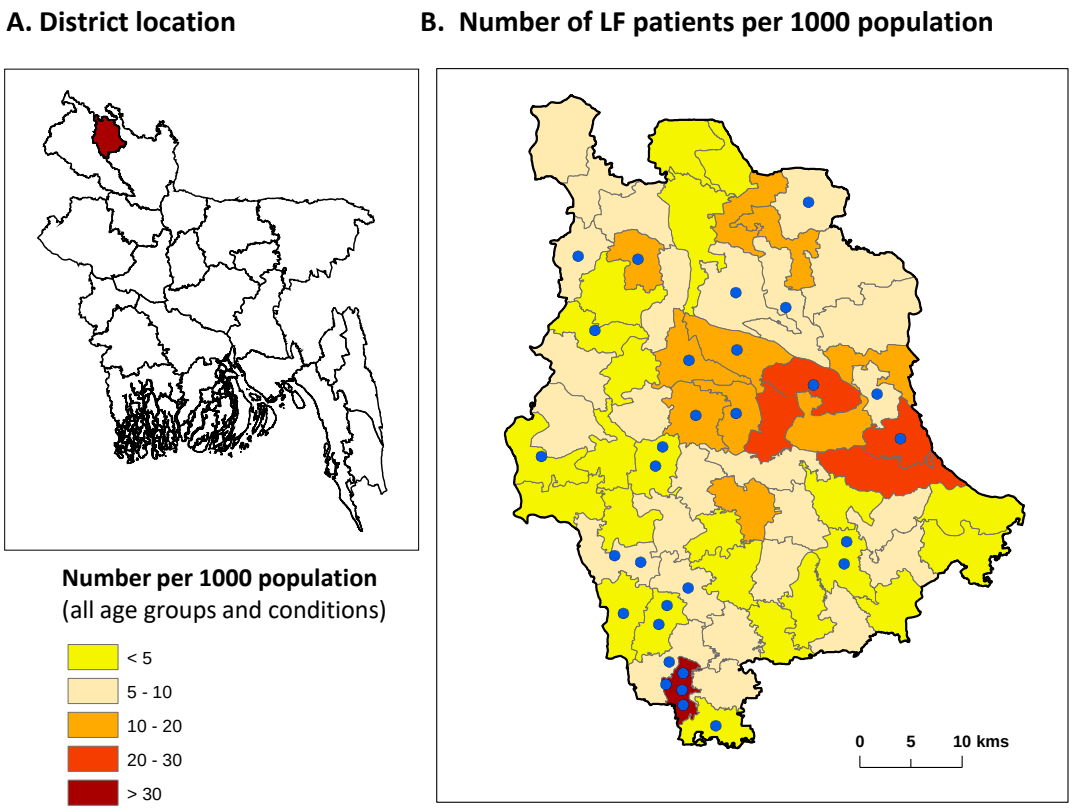
To estimate the number of clinical cases in Nilphamari district, a two stage 30-cluster survey was conducted over a 4-week period in March and April 2011. The district had an expected clinical case prevalence of 5 to 30% based on the previous clinical case survey noted above. The proposed sample size of 1200 individuals was designed to estimate the true LF prevalence with a precision (i.e. 95% confidence interval) of ±1.2% - 2.6%; adding a design effect of 2 to adjust for likely clustering effects, the precision will be ±1.6% - 3.7%. It was estimated that an average of 4 to 5 eligible individuals lived in each household, which resulted in a sample size of approximately 300 households with between 1200 and 1500 individuals being assessed for presence and severity of LF disease.

Survey clusters were randomly selected from the list of all villages in the district available from the Bangladesh Bureau of Statistics (2010). A village was considered a cluster, and the location of each village was geo-referenced using a GPS. For each village, 10 households were randomly selected from the central point of the village. First, a random direction was selected by spinning a stick or bottle, and then every alternate household was selected. Empty households were replaced with the next household. This process was conducted until the geographical end of the village was reached, and then the team returned to the centre and repeated the random direction selection until 10 households had completed the survey. All household members over the age of 10 were asked to participate after explaining and reading an informed consent. An assent form was provided for children more than 10 years age.

3.2.3 Field team

The data collectors consisted of experienced field workers who had worked previously with the LF programme on MDA implementation and survey activities. The lead investigator was a medical practitioner, who was working with the LF programme at the time of the survey and had extensive experience with LF patients, and therefore assessed all the clinical cases found during the survey. The team comprised the lead investigator, a final-year medical student, two experienced LF programme staff, and two field assistants who worked simultaneously in two groups in each village cluster. The field team was specifically trained before the survey to identify LF clinical cases, and if there was any confusion or ambiguity during the survey, the lead investigator reassessed the case to help reduce the chance of any cases being missed.

Figure 3.1 Study site and number of patients per 1000 population



3.2.4 Clinical assessment

For each individual included in the survey, their age and gender was recorded and a clinical assessment conducted to determine the presence of a hydrocoele in males, lymphoedema of the limbs, breast and labial in females, and episodes of acute dermatolymphangioadenitis attacks (ADLA).

1. The severity of the hydrocoele was graded according to size measured in centimetres (cm): Grade I = size <15 cm diameter, Grade II = size > 15cm diameter.

2. The severity of lymphoedema (legs only) was based on the Dreyer staging method (Dreyer et al. 2000) which included seven stages related to key clinical features as demonstrated in Dreyer et al, 2000 (Appendix iii)):

   - Stage 1: Swelling is reversible overnight; Stage 2: Swelling is not reversible overnight; Stage 3: Presence of shallow skin folds (base of the fold can be seen with movement of the leg); Stage 4: Presence of skin knobs; Stage 5: Presence of deep skin folds (base of the fold can only be seen if opened up); Stage 6: Presence of mossy lesions, warty looking epidermal skin lesions; Stage 7: Unable to care for self or perform daily activities (as tabulated in Smith et al).
   - Additional questions were asked related to the presence of entry lesions, interdigital lesions (including skin scaling, peeling, cracking, maceration, odour, pain, itching), lesion colour and dystrophic nails.

3. The questions related to ADLAs included whether they were currently having an acute attack; the number of attacks experienced in the past 6 months, and the number of days each attack usually lasts. The 6-month average ADLA rate per person for men and women was quantified based on the total number of attacks reported, divided by the total number of individuals with lymphoedema and multiplied by 1000.

4. Clinical assessments were conducted in privacy as per individual's request. Individuals found to have clinical conditions were provided with a hygiene kit and information on the management and treatment of their specific condition and referred to the local clinic.

3.2.5 Serological Infection rates

A secondary objective was to establish the evidence of serological infection among the surveyed individuals. All individuals identified with LF clinical condition, and one additional individual per household to establish non-clinical infection rates, were invited to be tested for circulating filarial antigen (CFA) using the rapid diagnostic ICT card with 100ul of blood, according to manufacturers' instructions (Weil et al , 2007). Individuals who were found to be ICT positive were invited to be tested for Mf of *W. bancrofti* in night blood samples (60 ul blood on slides) collected between 22.00 and 23.00 h (McMohan et al, 1979). All positive individuals were offered standard drug treatment of albendazole and DEC, and information on preventive measures.

3.2.6 Data analyses and mapping

All data were entered into Microsoft Excel Version 12.3.6 (Microsoft Corp., Redmond, VA, USA) and analysed in IBM SPSS Statistics 22 IBM Corp., Armonk, NY, USA). Cross tabulation, chi square tests and independent samples t-test using a 5% significance level were used to determine the relationship between clinical disease and age, sex, and location. The location of the 30 village clusters and location of clinical cases were mapped using ArcGIS 10 (ESRI, Redland, CA).

3.2.7 Ethical consideration

All the information provided by participants as a part of the study was kept confidential by research group. Data entry was anonymous and only a code number was provided during data entry. Papers and electronic copies of data are stored in a secure storage or password protected location where only the PhD student and supervisors have access. Any data in connection with the study will be used in a manner that does not disclose the identity of the subjects.

Written consent to conduct the survey and blood collection as part of the serological survey was obtained. All the procedure were verbally discussed with the survey participants and additional permission to take photos was obtained. Before conducting the survey, a meeting with the local village/community leaders and local health officials was conducted.

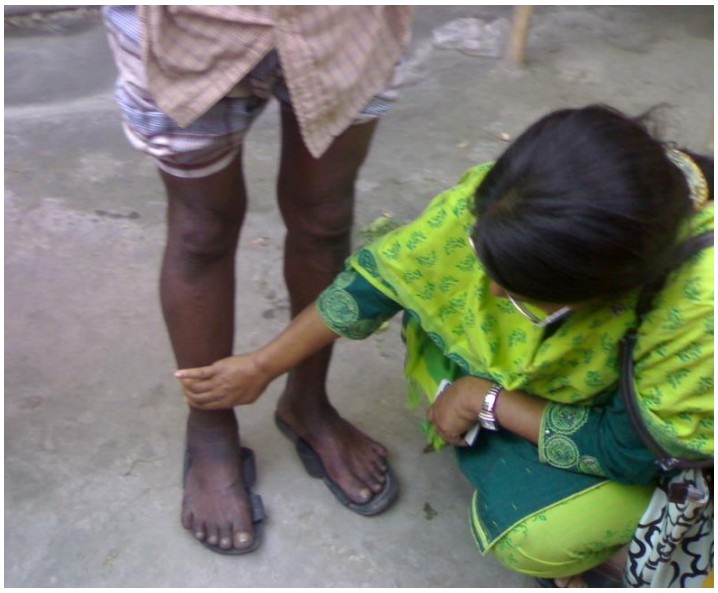
3.3 Results

3.3.1 Survey villages

The selected 30 village clusters by each upazila and union of Nilphamari District are listed in Table 3.1. The locations of the village clusters are mapped in Figure 3.3 in relation to previous union level case data per 1000 population collected by JICA and the LF Programme in 2005 (unpublished data). Each upazila had between three and nine villages selected, and four unions had more than one village selected which resulted in a total 30 villages across six upazilas and 23 unions of the district.

A total of 1242 individuals from 297 households were surveyed, including 625 males (50.4%) and 616 females (49.6%). The distribution of males and females across the villages and upazilas did not differ significantly. The overall average age was 32 years, ranging from 10 to 110 years (males 33 years, females 30 years).

Figure 3.2 Photograph showing an assessment of the lymphoedema



3.3.2 Clinical cases

In total, 55 clinical cases were identified and are listed by village and union in Table 3.1. The overall clinical LF prevalence was 4.4% (95% CI 3.4 to 5.7%) among those surveyed in this district (Table 3.2). Lymphoedema of the leg was the single most common condition with 25 individuals (25/55; 45.5%) affected with this condition alone. Around one third of these individuals (8/25; 32.0%) had both legs affected. The second single most common clinical condition was hydrocoele with 22 individuals (40.0%) affected. Four individuals were found

to have lymphoedema of the breast (7.3%). Three had a combination of leg lymphoedema and hydrocoele (5.5%), one individual had a combination of leg and arm lymphoedema, and a hydrocoele (1.8%). Taking the clinical cases with combined pathology into account, a total of 29 individuals had leg lymphoedema and 26 individuals had hydrocoele.

Table 3.1 Village clusters and number of clinical cases and infections in Nilphamari district

No	Upazila (No. surveyed; ICT tested)	Union	Village	Lymph (leg)	Hydro	ICT	MF
1	**Dimla**	Dimla	Uttar Tita para	1			
2	(N=125; ICT=28)	Naotara	Akashkuir		1		
3		Tepa kharibari	Char kharibari				
4	**Domar**	Bamunia	Bamunia	1	2		
5	(N=87; ICT=35)	Domar	Chikonmati	3			
6		Jorabari	Uttar Ketakibari				
7	**Jaldhaka** (N=294;	Balagram	Salangram	1	1	1	1
8	ICT=77)	Dharmapal	Kherkati				
9		Golmunda union	Tilai	1			
10		Golna	Kharija Golna				
11		Mirganj	Arazi Pathan para	2	2		
12		Shimulbari	Banshdaha		2		
13		Saulmari	Taluk Saulmari	1	1	2	1
14	**Kishoregonj**	Kishoregonj	Kishoregonj		1	1	1
15	(N=82; ICT=20)	Kishoregonj	Dakshin Rajib	3	1		
16	**Sadar**	Charaikhola	Charaikhola		2	1	
17	(N=353; ICT=122)	Gargram	Gargram	4	4		
18		Kunda pukur	Khoka para				
19		Kunda pukur	Sutipara				
20		Sangalshi	Kadikul		1		
21		Sangalshi	musrat kukhapara	1			
22		Sonaroy	Paschim Arazi Charaikhola		1		
23		Tupamari	Dolua Dogachi	3 (+1)*	1		
24		Tupamari	Sukhdhan				
25	**Saidpur**	Paurashava-ward 4	Atiar colony	1			
26	(N=301; ICT=65)	Paurashava-ward 7	Puratan babupara			1	1
27		Paurashava-ward 12	Sahebpara Dakshin	2	1		
28		Paurashava-ward 15	Banshbari Uttar				
29		Bangalipur	Lakshampur Charak Para		1		
30		Bothlagari union	Kismat Kadikul	1(+4)**	4		

*(+1) = arm lymphoedema

** (+4) = Breast lymphoedema

Upazila total population in 2011 (Census): Dimla 175,507; Domar 187,696; Jaldhaka 233,885 Kishoregonj 199,422 Sadar 306,051 Saidpur 246,201

The geographical distribution of the study sites recording any lymphoedema and hydrocoele cases is shown in Figure 3.3. There was no obvious geographical pattern to the distribution of either condition across the district. In total, at least one condition was found in 21 out of the 30 village clusters (70%), with 10 villages reporting both lymphoedema and hydrocoele, one village reporting breast and arm lymphoedema. The majority of households (n=30; 76.9%) had one case only, while around a quarter of households had multiple cases. Three households (7.7%) reported two cases, 5 households (12.8%) reported three cases and 1 household (2.6%) reported four cases (Figure 3.4). The 55 cases were found in 39 out of the total 297 households.

Table 3.2 Parts of the body affected by clinical conditions by gender

Area affected	Number of cases					
	Males	(%)	Females	(%)	Overall	(%)
Leg lymphoedema	6	(18.8)	19	(82.6)	25	(45.5)
Hydrocele	22	(68.8)	0	(0)	22	(40.0)
Breast	0	(0)	4	(17.4)	4	(7.3)
Leg lymphoedema/hydrocele	3	(9.3)	0	(0)	3	(5.4)
Leg lymphoedema/hydrocele/arm	1	(3.1)	0	(0)	1	(1.8)
Total (Overall prevalence)	**32**	**(5.1%)**	**23**	**(3.7%)**	**55**	

Chi square test: p value= 0.000

Figure 3.3 Village location of LF patients with clinical diseases and infection

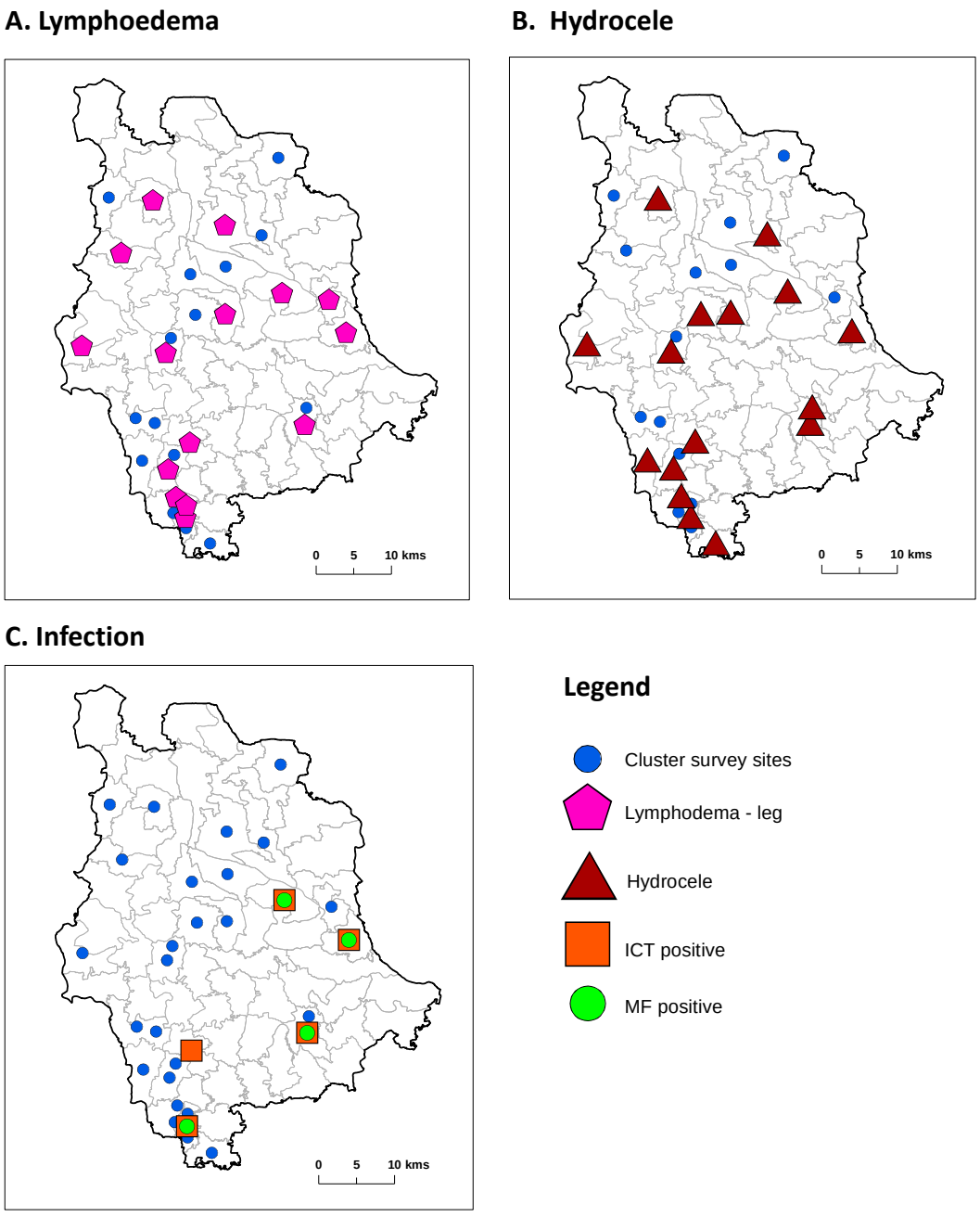
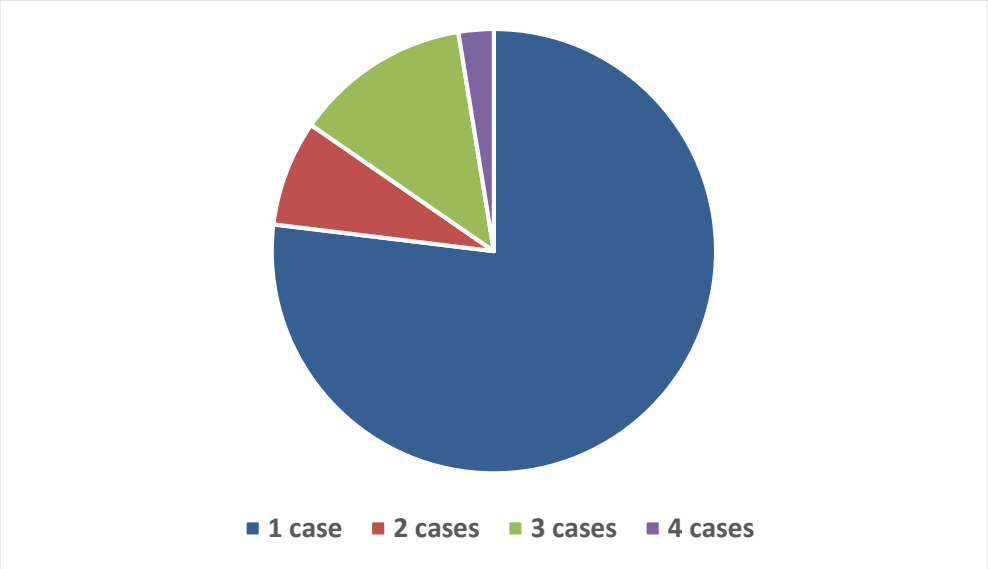


Figure 3.4 Proportion of households with multiple lymphatic filariasis clinical cases.



The overall LF disease prevalence was higher in males (5.1% (n=32)) than females (3.7% (n=23)) but the difference was not statistically significant (Chi sq = 1.4075, p = 0.235). There were differences in the body parts affected as shown in Table 3.2. Males were predominately affected by hydrocoele, either alone or in combination with other conditions (hydrocoele total n=26; prevalence 4.2%). Two thirds of hydrocoeles were classified as Grade 1 (average age 42), and one third as Grade 2 (average age 51 years). Females were predominately affected by leg lymphoedema (n=19; prevalence 3.1%) representing two thirds of the total number (leg lymphoedema total =29) with double the lymphoedema prevalence of men. Overall, 13 (44.8%) lymphoedema cases had only their right leg affected, 8 (27.6%) had only their left leg affected, and 8 (27.6%) individuals had both legs affected.

Overall, the average age of the 55 individuals with clinical conditions (47 years) was significantly higher than those without (31 years) ($p<0.001$). The number of cases and age-specific prevalence of LF disease increased with age (Table 3.3) (Figure 3.4). This increasing trend was also evident for leg lymphoedema and hydrocoele cases when examined separately as shown in Table 3a and b.

Table 3.3a Age and sex distribution of lymphoedema cases

Age group (years)	Number of cases					
	Male	(%)	Female	(%)	Overall	%
10-19	0	0	0	0	0	0
20-29	2	(20.0)	1	(5.3)	3	(10.3)
30-39	0	(0)	2	(10.5)	2	(6.9)
40-49	1	(10.0)	5	(26.3)	6	(20.7)
50-59	5	(50.0)	5	(26.3)	10	(34.5)
≥60	2	(20.0)	6	(31.6)	8	(27.6)
Total	**10**		**19**		**29**	

Chi square test: p value= 0.000

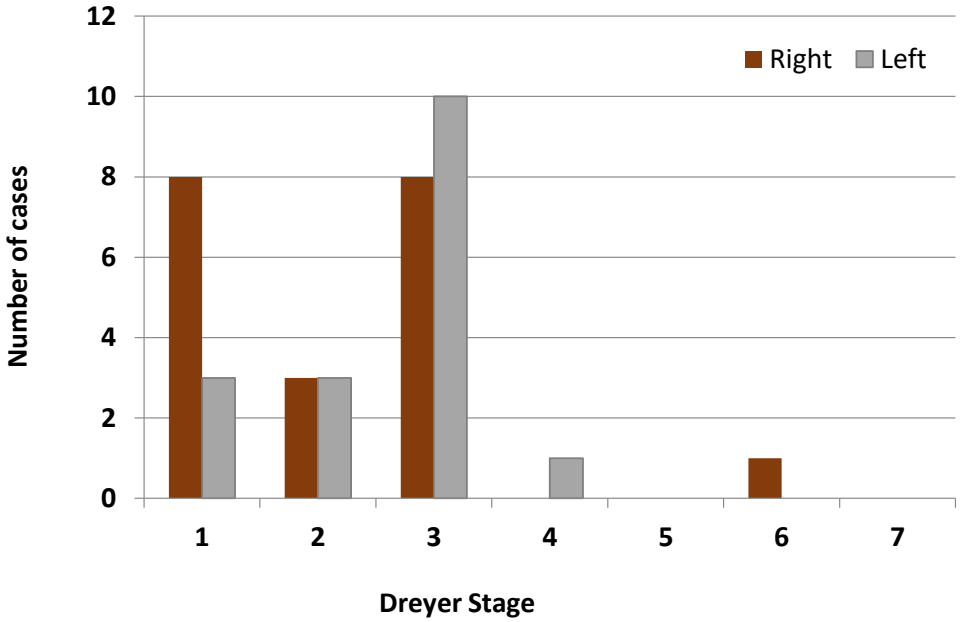
Table 3.3b Age distribution of hydrocele cases

Age group (years)	Number of cases	
	Male	(%)
10-19	2	(7.7)
20-29	1	(3.8)
30-39	8	(30.8)
40-49	2	(7.7)
50-59	5	(19.2)
≥60	8	(30.8)
Total	**26**	

3.3.3 Stage of leg lymphoedema

A total of eight individuals (8/29; 27.6%) were found to have Stage 1 (3 males; 5 females), three individuals (10.3%) were at Stage 2 (3 females), 16 individuals (55.2%) were at Stage 3 (5 males; 11 females) and only one male individual had bilateral lymphoedema with Stage 4 and Stage 6 (3.4%) (Figure 3.3). None of the individuals surveyed had the most advanced Stage 7. For the individuals with more than one leg affected, only the highest Dreyer stage was included in the analysis. Similar average staging level was found between men and women, but there was a significant difference by age group ($p<0.001$). Additional questions relating to other skin conditions found only one female individual (Stage 2 lymphoedema) with entry lesions, interdigital lesions, skin peeling, skin cracking and pain.

Figure 3.5 Acute dermatolymphangioadenitis attacks (ADLA)



At the time of the survey, four individuals (13.8%; 1 male, 3 females), reported suffering from an ADLA (Table 3.5). There was no significant difference in ADLA frequency by lymphoedema stage, gender or age group. The 6-month average ADLA rates were similar for men with 170 ADLAs per 1000 lymphoedema cases (total 17 ADLAs/10 individuals) and women at 200 ADLAs per 1000 lymphoedema cases (total 38 ADLAs/19 individuals). When asked about the duration of attacks, three individuals (10.3%) reported they lasted 1 to 2 days, 13 individuals (44.8%) reported they lasted 3-4 days, five individuals (17.2%) reported they lasted 5 days or more (Table 3.5). There was no significant difference in ADLA duration by lymphoedema stage, sex or age group.

Table 3.4 Frequency of acute dermatolymphangioadenitis (ADLAs) in the past 6 months in participants with leg lymphoedema by gender.

Number of ADLAs in the past 6 months	**Number of participants**					
	Male	**(%)**	**Female**	**(%)**	**Overall**	**(%)**
None	4	(40.0)	4	(21.1)	8	(24.1)
1	0	(00.0)	4	(21.1)	6	(20.7)
2	4	(40.0)	6	(31.5)	9	(31.0)
3	1	(10.0)	1	(5.3)	2	(6.9)
4	0	(0)	2	(10.5)	2	(6.9)
≥5	1	(10.0)	2	(10.5)	3	(10.3)
Total	**10**		**19**		**29**	

Table 3.5 Duration of acute dermatolymphangioadenitis (ADLAs) in days in the past 6 months in participants with leg lymphoedema by gender

Duration of ADLAs in days in the past 6 months	Number of participants					
	Male	(%)	Female	(%)	Overall	(%)
None	4	(40.0)	4	(21.1)	8	(27.6)
1 to 2	1	(10.0)	2	(10.5)	3	(10.3)
3 to 4	5	(50.0)	8	(42.1)	13	(44.8)
≥ 5	0	(0)	5	(26.3)	5	(17.2)
Total	10		**19**		**29**	

3.3.4 Evidence of Infection

In total 353 individuals were tested with ICTs (39/55 clinical cases; 206/297 individuals per household; and 108/206 additional requests to be tested from individuals) as summarised in Table 3.6. Of the 39 individuals with LF clinical conditions tested, only one male with a hydrocoele (Stage 1) aged 56 years was ICT positive, and also found to be Mf positive.

From the 206 individuals without clinical conditions who were tested, three males were ICT positive (1.5%) aged 15, 35 and 50 years, with the latter two males also found to be Mf positive.

From the additional 108 individuals requesting to be tested, two males were ICT positive (1.9%) aged 24 and 28, with the former male also found to be Mf positive. The number of individuals positive by ICT and Mf by village is shown in Table 3.1 and Figure 3.2. The difference between ICT positivity rates in clinical and non-clinical cases was not significant (p= 0.507, by Fisher's exact test).

Table 3.6 Summary of individuals tested for infection

Group	Total No.	No. tested by ICT	No. ICT Positive	% ICT Positive (95% CI)	No. Mf Positive
Clinical cases	55	39	1	2.6% (0.05 - 13.5%	1
Other main household members selected	297	206	3	1.5% (0.3 - 4.2%)	2
Additional household members requesting testing	108	108	2	1.9% (0.2 - 6.5%)	1
Total		353	6	1.7% (0.6 - 3.7%)	4

Figure 3.6 Photograph of conducting a rapid diagnostic test using the ICT card

3.4 Discussion

The LF Programme in Bangladesh is making good progress towards elimination of LF with more than five rounds of MDA completed in all endemic districts. The majority of districts are now verifying the interruption of transmission through the standard WHO TAS. This cluster survey indicates an overall low prevalence of disease found in an historically endemic area of the country (Barry et al, 1971). Further, very few individuals were found to have advanced stage disease and these people tended to be in the older age groups.

It will be important to have systems in place to monitor the clinical cases and detect new cases that may develop over time from persons infected before the interruption of transmission. Health workers will be able to play a role in this as it has been shown that they can readily identify the stage of lymphoedema with high agreement, as well as refer patients for hydrocoele surgery (Dreyer et al, 2000). Integrating surveillance into the national health system will help to confirm the ongoing interruption of transmission and reduction in morbidity cases, and thus contribute to the successful elimination of LF as a public health problem (Ramaiah et al, 2014).

The clinical cases were found to be wide-spread across the district with no obvious geographical pattern, which may be related to the relatively homogenous demographics of the population (BBS, 2015). It may also be related to the widespread poverty and ubiquitous nature of the local mosquito vector *Culex* spp. which thrives in poor domestic environments (Aslam khan et al, 1972, Ahmed et al, 1986). However, it is important to further investigate and understand why no evidence of disease and infection were found in eight (around one quarter) of the villages across the district. It may be because these villages are somehow different to the others, or it could be that the cluster survey may not be the most suitable method for detecting LF cases at village level.

Currently there is no specific survey method recommended for identifying and mapping clinical cases on a large geographical scale. However, there are new community-based tools using phone technology being developed and trialled in endemic areas of Africa, resulting in linked geo-referenced morbidity databases of village-level information that will help to direct resources (Stanton et al, 2014). The use of such innovative tools to improve detailed morbidity mapping in Bangladesh and other LF Programmes is increasingly important as they move their efforts towards scaling up MMDP. Furthermore, the WHO will most likely require

clinical case estimates, as well as evidence of service access and delivery, before considering the verification of elimination (Addiss et al, 2007 and Brady et al, 2014).

Overall males and females had similar prevalence estimates but were affected by different conditions. Males were mostly affected by hydrocoele, and females by leg lymphoedema, which is a disease pattern that has recently been found elsewhere in a post-MDA setting (Smith et al, 2014 and Stanton et al, 2015). Public health campaigns and MMDP strategies will therefore need to take these gender differences into account to ensure the right messages and appropriate care are tailored to the right population sub-groups. Groups with milder or emerging evidence of disease may be more readily treatable and their condition potentially reversible with specific treatment strategies. However, there is as yet little information and no specific method for detecting the early stages of disease in endemic areas that would be practical to implement across a country such as Bangladesh as part of the National LF Elimination Programme (Gordon et al., 2011).

The fact that few very advanced clinical cases were found in this survey suggests that the LF Programme could consider a predominantly home-based morbidity control protocol for lymphoedema cases. A recent review of research indicated that early use of simple hygiene measures, self-massage, limb elevation and exercise have the capacity to limit the severity of lymphoedema (Douglas et al, 2013, Mues et al, 2014). However, for hydrocoeles, the vast majority of affected individuals will require surgery. The expansion of training and provision of resources to support district-level surgical teams is critically important to address the burden in men, especially as surgery significantly improves the quality of their Plives and ability to work (Stanton et al, 2015, Babu et al., 2009, Athorlu et al, 2001, Capuano et al, 2012). It may also be possible to treat milder hydrocoele cases with non-surgical drug therapy such doxycycline. This practice is currently not a standard recommendation and may not be effective in all situations (Debrah et al, 2014) but it could be a highly beneficial and cost effective intervention for LF Programmes (Mand et al, 2012, Debrah et al, 2006, Mand et al 2009, Hoerauf et al, 2011, Wanji et al, 2009, Taylor et al, 2010).

Doxycycline has been identified as an anti-morbidity drug for the treatment of filariasis (elephantiasis) (Taylor MJ et al., 2005). On study shows minocycline is superior than doxycycline regimen as anti Wolbachia macrofilacide (Sharma R., et al, 2016). Mand, S., et al.,2012 has demonstrated Doxycycline improves filarial lymphedema independent of active filarial infection in a randomized controlled trial.

The future study will focus on testing a defined panel of registered tetracyclines and novel tetracycline derivatives for improved anti-morbidity effects, focusing on in vitro and in vivo assays of anti-angiogenic / anti-inflammatory modes of action

The clinical conditions of LF in general are known to have a detrimental impact on people's lives (Stanton et al., 2015, Zeldenryk et al, 2011, Zeldenryk et al, 2013, Martindale et al, 2014, Krishna Kumari et al, 2005, Litt et al, 2012), but, the incidence and specific effect of ADLAs is one aspect that is not well understood. The scope of the ADLA problem and contribution of attacks to an individual's disability, poor socio-economic status and mental well-being is likely to be underestimated, as highlighted in a recent survey in Malawi (Martindale et al, 2014). As in Malawi, in Bangladesh the majority of lymphoedema cases experienced ADLAs regularly during a six-month period with an average episode lasting several days. We acknowledge that there may be recall bias in asking individuals to remember and report such attacks, but this does provide some key information to be investigated further. Understanding the physical impact and the role of ADLAs in the progression of the disease, as well as how they may influence the socio-economic status of individuals and their families, need to be priority areas of research to improve MMDP strategies.

This was the first cluster survey to investigate the number of LF clinical cases and infections in Bangladesh after an extensive period of mass drug treatment. Other countries should consider a similar methodology to help develop and promote their MMDP strategies. We found some evidence of persistent infection in the district, with a small number of ICT and Mf positive individuals providing a possible reservoir of infectious individuals. While the low rate of ICT positivity in people with clinical filariasis is not a new finding, the extent to which this is a problem among family members warrants further investigation. Many people refused to be tested or were not at home during the survey, and no information on their migration history was undertaken. It is possible that future surveillance activities associated with the interruption of transmission could be linked with MMDP activities in the future, as both activities are key components of the LF Programme and their successful implementation is essential for the endgame (WHO, 2013, Ramaiah et al, 2014, WHO, 2011).

3.5 Conclusion

This study conducted in an historically LF endemic district after more than a decade of MDA to interrupt transmission, highlights the overall low prevalence of advanced stages of disease and that the Bangladesh LF programme will need to develop the different MMDP strategies to address the diversity of needs related to the low prevalence of LF disease in younger age groups, the overall lack of advanced stage disease, the significant differences in conditions between males (hydroceles) and females (leg lymphoedema), and the potential detrimental impact of ADLAs.

Chapter Four

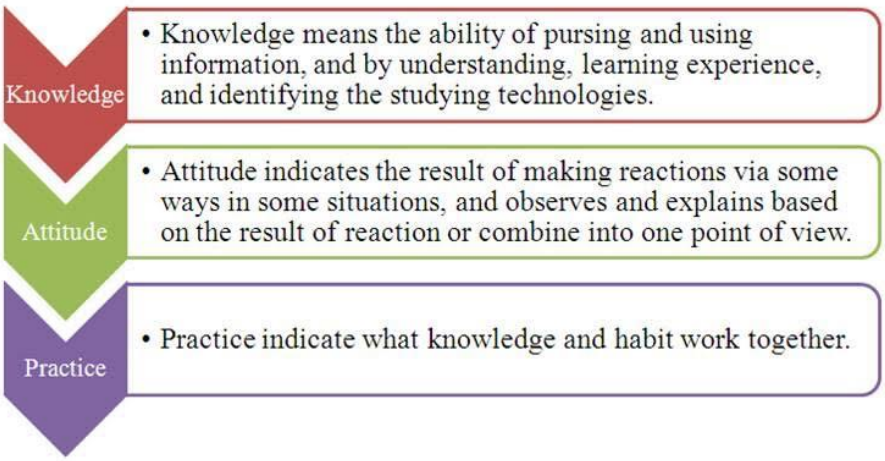
Knowledge, attitude and practice (KAP) of community members and patients of lymphatic filariasis

4.1 Introduction

Understanding the community knowledge of disease and what they perspectives on control programmes is important. A KAP study conceptual framework has been traditionally used for behavioural changes in health sectors. KAP study meaning is explained in figure 4.1. There are many ways to extract information from patients. However, the most common approach is a survey method known as Knowledge, Attitude and Practice (KAP). KAP studies on LF have been done in Indonesia (Krentel et al., 2006), Haiti (Mathiu et al, 2004) and Malaysia (Al Abd et al, 2014) which demonstrated very useful information about LF and its elimination programme. Furthermore, these studies helped to develop better message for public campaign. To date no study has been conducted in Bangladesh.

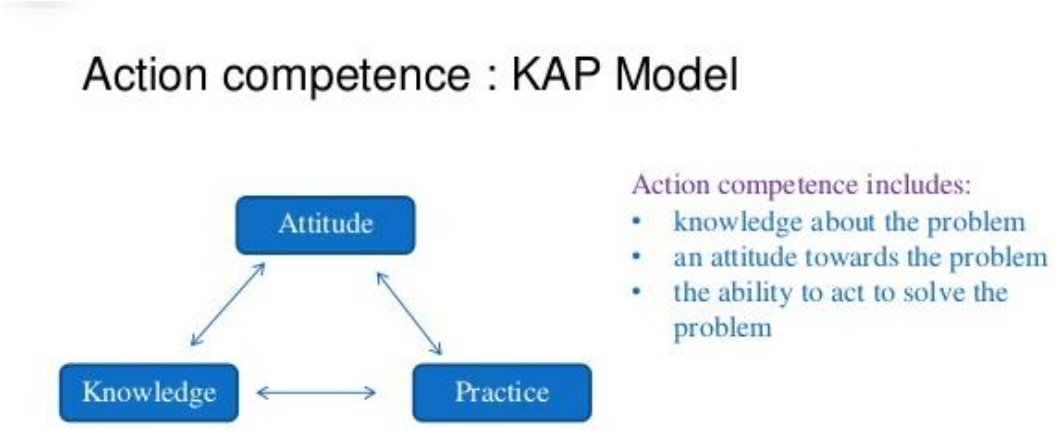
The aim of this study therefore was first to conduct a survey on local community members to determine their KAP of LF, and second to specifically to elicit information from individuals affected by clinical condition of LF and ask them generally about their morbidity management.

Figure 4.1 KAP Study meaning.



KAP conceptual framework
(Source;https://www.google.com.au/search?q=kap+study+conceptual+framework&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjdwvKK_LrZAhULxbwKHQg8BgQQ_AUICigB&biw=1242&bih=557&dpr=1.1#imgrc=xhtZEbg4M6cVlM)

Figure 4.2 KAP Model



Source: (Saugstad et al, 2003)

4.2 Methods:

4.2.1 Study site and sampling strategy

The study was conducted in Nilphamari District in the same villages and households as those described in Chapterthree, which contains details of the study area and sampling methodology. Briefly, the household KAP survey was conducted as part of a cluster survey, where individual villages were considered clusters, which were randomly selected from the list of all villages in Nilphamari. For each village cluster, 10 households were randomly selected from a central point. Within each household, the head of the household over 18 years of age was invited to participate in the survey, or if an individual with LF clinical conditions were present, then they were invited to participate as in the survey with the permission of the head of the household. Only one individual per household was included in the survey.

4.2.2 Questionnaire

For each individual included in the survey, socio-demographic information and questions on a range of topics including knowledge of filariasis, Knowledge of treatment and prevention Opinions on transmission and elimination and clinical management and impact were collected, collated and analysed. A summary of the five main sections of the survey and the related sub-

sections (question themes) are summarised below. The full questionnaire in both English and Bengali are available in the Appendices.

1. Socio-demographic characteristics

   - Upazilla
   - Sex
   - Age
   - Education level
   - Occupation
   - Religion

2. Knowledge of filariasis

   - Knowledge of LF
   - Source of information
   - Symptoms of disease
   - Type of disease
   - Method of transmission

3. Knowledge of treatment and prevention

   - Main method of prevention
   - Knowledge of MDA
   - Participation in MDA
   - Source of information of MDA
   - Mosquito control /personal protection

4. Opinions on transmission and elimination (scale – agree/disagree statements)

   - Transmission– personal contact, a curse, same house living
   - Prevention/treatment – curable, vaccination, elimination possibility

<u>Section refers to patients only</u>

5. Clinical management and impact

   - Additional clinical conditions – pain, redness, odour, fever, heaviness
   - Difficulties on aspects of life – walking, household work, occupation, moving/travelling
   - Measures take to alleviate condition
   - Training and supplies to look after condition
   - Hydrocele specific – knowledge of treatment, surgery

4.2.3 Data analyses and mapping

All data were entered into Microsoft Excel Version 12.3.6 (Microsoft Corp., Redmond, VA, USA) and analysed in IBM SPSS Statistics 22 IBM Corp., Armonk, NY, USA). Cross tabulation, chi square tests and independent samples t-test using a 5% significance level were used to determine the differences between variable and the relationship between KAP and age, gender.

4.3 Results

4.3.1 Socio-demographic characteristics

A total of 297 people of 297 households had been participated in the study. 3 households refused to participate in the survey. Of the 297 respondents, 97 (32.7%) were male and 200 (67.3%) were female. The general socio-demographic characteristics of the respondents were presented in table 4.1. Overall the mean age of respondents was 36.47 $\pm$ 15.02 years. The average age for males was 41 years and for females was 34.3 years. Most of participants are in age group of 21-30 (27.3 %) and 31-40 (23.3 %) years, while the age group > 70 years had least number of participants. Of the respondents 99.7% had received educated: 61.3% at the primary level, 25.9 % at the secondary level and 4.7% at tertiary level. About 56.6% of respondents were housewife, 12.1% were doing agriculture, 9.5% were businessman, 8.4 % were day labour and 8.1% were students. Of the total respondents 89.6% were Muslims, 10% were Hindu and 0.3% were Buddhist.

4.3.2 Knowledge of filariasis

When the respondents were asked about if they knew of LF, the vast majority (98.0% n=291) stated that they that heard about filariasis as shown in Table 4.2. When asked about the source of information, the majority receive from the health worker (74.1%).

Table 4.1 Socio-demographic characteristics of study population.

Variable	Number (N=297)	Percent (%)
Sex		
Male	97	32.7
Female	200	67.3
Age		
11-20 years	47	15.8
21 - 30 years	81	27.3
31 - 40 years	75	25.3
41 -50 years	47	15.8
51 - 60 years	24	8.1
61 - 70 years	19	6.4
71 - 80 years	4	1.3
Educational level		
Illiterates	1	0.3
Primary	182	61.3
Secondary	77	25.9
Higher secondary	23	7.7
Graduation	13	4.4
Post-graduation	1	.3
Occupation		
Agriculture	36	12.1
Service	8	2.7
Business	28	9.4
Day labour	25	8.4
Technical	1	.3
Housewife	168	56.6
Student	24	8.1
Others	7	2.4
Religion		
Muslim	266	89.6
Buddhism	1	0.3
Hinduism		10.1
	30	

(n=297): No people were there in 3/300 Houses.

70.7% knew about diseases from diseased friend while 44.1% knew from leaflet-folder supplied by Filariasis elimination programme. About 45.8% knew from television as demonstrated in the table 4.2. There was some variation found in the study between male and female. Female were getting information about disease primarily from Health Assistants, Doctors, folders/leaflet and friends while male respondents were getting information from radio and newspapers, miking, and doctors.

About 72.4% of respondents responded that they knew about symptoms of filariasis while 27.6% responded negatively. About 77.2% responded that pain is main symptom of Filariasis and 64.7% knew about fever as a main symptom of Filariasis. Regarding main symptoms, about 85.1% and 96.3% knew urticaria and gradual swelling subsequently. Moreover, majority of them (90.2%) opposed to false statement about diarrhoea and vomiting, being a main symptom of Filariasis. Very few number of respondents mentioned about vague symptoms like cannot eat, cannot walk and vertigo shown in figure 4.3.

Regarding type of disease, only about 10.4% told it is an infectious/contagious disease it. The rest of the respondents stated that filariasis is a hereditary (30.3%) or tumorous/cancerous (1.7%) condition, while 44.8% stated they did not know what type of disease it is, as shown in the Table 4.2. When asked about mode of transmission of disease, almost half (44.4%) of respondents stated filariasis is transmitted through mosquito bites. 6.1 % told that it is transmitted through food/water and 4.4% told about personal contact while 41.1% mentioned they don't know the mode of transmission. Only 3 % stated it was spread through cough/sneezing (Table 4.2).

Table 4.2 Respondents' knowledge of lymphatic filariasis

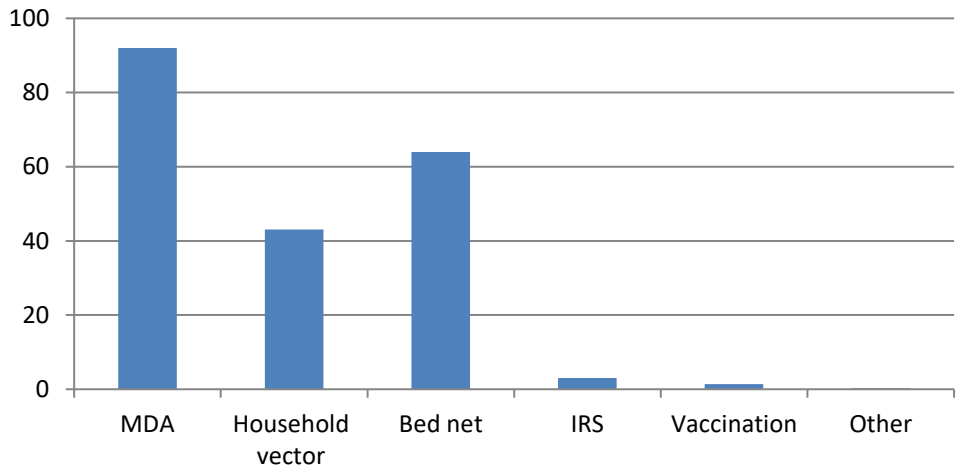
Variable	Number (N=297)	Percent (%)
Knowledge about lymphatic filariasis	N=297	
Yes	291	98
No	6	2
Knowledge about symptoms of disease	N=297	
Pain	167	26.5
Fever	142	22.5
Urticaria	34	5.4
Vomiting & diarrhea	23	3.6
Gradual swelling of different parts of Body	265	42.0
Source of information (Multiple response)		
Health assistant	220	74.1
Doctor	52	17.5
Radio	23	7.7
TV	136	45.8
Newspaper	35	11.8
Diseased friend	210	70.7
Leaflet-folder	131	44.1
Miking	89	30.0
Method of transmission	N=297	
Through food/ water	18	6.1
Personal contact	13	4.4
Mosquito bite	132	44.4
Sneezing /Cough	9	3.0
Other	3	1.0
Don't know	122	41.1
Knowledge about what type of disease	N=297	
Infectious/contagious	31	10.4
Hereditary	90	30.3
Tumorous/cancerous	5	1.7
From bad air	11	3.7
Other	27	9.1
Don't know	133	44.8
Knowledge about MDA as preventive measure	N=297	
Yes	273	91.9
No	9	3.0
Don't know	15	5.1

(n=297): No people were there in 3/300 houses.

4.3.3 Knowledge about treatment and prevention

When asked about the main method of filariasis prevention, the majority stated that MDA from the national LF programme (92%), however a large percentage also mentioned the use of bed nets (64%) and household vector control (43.1%) with very few people stating other factors such as indoor residual spraying, vaccination or other as shown in Figure 4.4.

Figure 4.3 Knowledge of preventative measure for filariasis



When asked about MDA as a preventive measure, 91.9 % respondents that they have knowledge about MDA and 8.1% said they have no idea about MDA. Among the participants about 37.4% participated 5 times and more than half of respondents participated in 1-4 times in MDAs shown in table 4.3. Of the 6.4% respondent who did not take MDA, the main reasons were related to i) they did not receive the medicine (n=18; 6.1%), ii) they were absent from home (n=16; 5.4%), iii) lack of awareness (n=18; 6.1 %) and iv) Fear of side effect (n=12; 4%).

Regarding source of information about MDA, 81.6% knew from health workers (related HW Chapter), 11.8% informed they are aware (Table 4.3) about MDA and rest of people are informed by doctors, Television/radio, loud speakers/miking and leaflet etc. Regarding prevention of disease, 65% informed that LF can be prevented by taking drugs in MDA once in a year for subsequent 5 years and 35 % said they don't know. When asked from where programme free of cost.

When asked about preventive measures from mosquito bite, about 98% informed that they use any sort of protection measures. Among them majority of them use mosquito net (97.6%). A few respondents use mosquito coil, spray and electric coil. Most of the respondents (84.5%) also mentioned they clean their surrounding area for vector control.

Table 4.3 Respondents' knowledge of MDA

Variable	Number (N=297)	Percent (%)
Knowledge about MDA as preventive measure	**N=297**	
Yes	273	91.9
No	9	3.0
Don't know	15	5.1
Participation in MDA	**N=288**	
O times	20	6.4
1 times	30	10.1
2 times	46	15.5
3 times	63	21.2
4 times	18	6.1
5 times	111	37.4
Media of knowing cause of taking medication in MDA	**N=272**	
Advised by Health Assistant	222	81.6
Advised by doctors	7	2.6
Informed by Radio, TV	1	0.4
Aware about prevention of LF	32	11.8
Want to prevent transmission of LF	6	2.2
Want to protect future generation	0	0.0
Other	1	0.4
Don't know	3	1.1

(N=297): No people were there in 3/300 houses.

Figure 4.4 Additional signs and symptoms experienced by individuals with clinical conditions

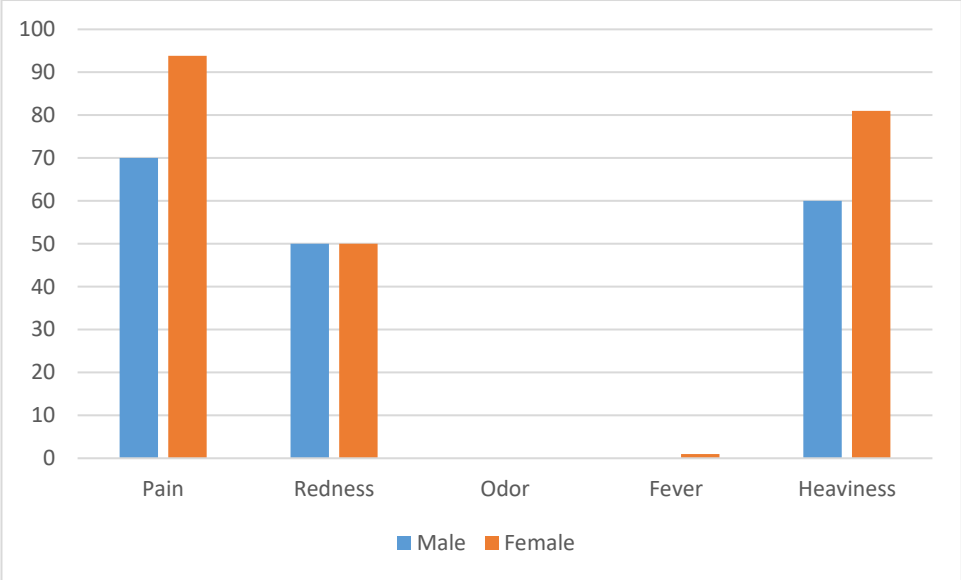
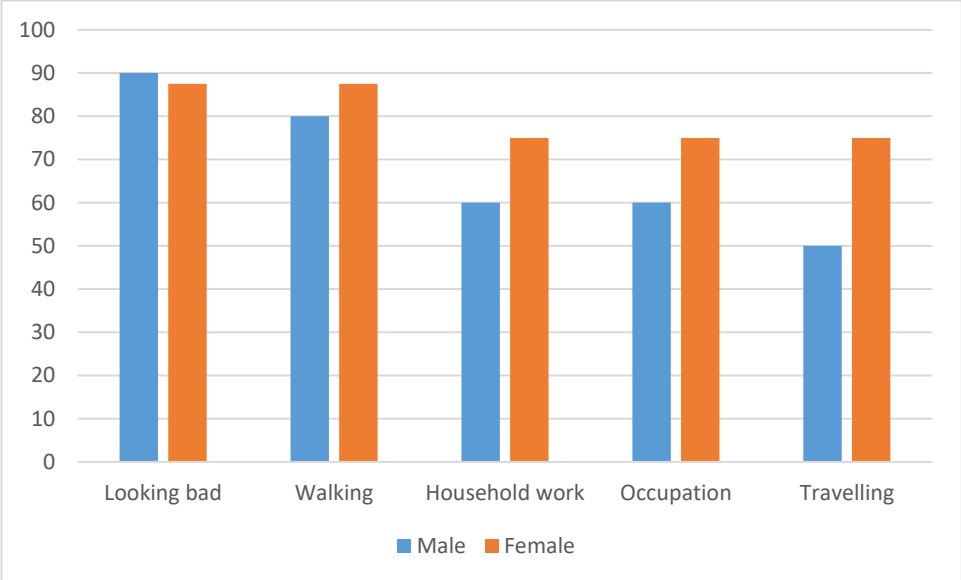


Figure 4.5 Difficulties experienced by individual with clinical manifestations



4.3.4 Measures taken alleviate condition

Questions related to morbidity to get relief, advise from doctors, length of use of measure, type of improvement noticed, whether it was easy to implement. Overall, they were found

to not practice the measures regularly as shown in Table 4.4 and Figure 4.7. However, some of them (13 out of 26) use cleaning/washing with soap and some of them (11 out of 26) are wearing sandals. Nobody uses bandages at all. Very few of them do exercise (5 of 26) and practice leg elevation (4 of26). Furthermore 5 of 26 use traditional method.

4.3.5 Training and supplies

On total only 4 people (male-1 & female-3) stated that they have received training for their clinical condition. When asked about supplies provided from the government only one person stated they have received soap.

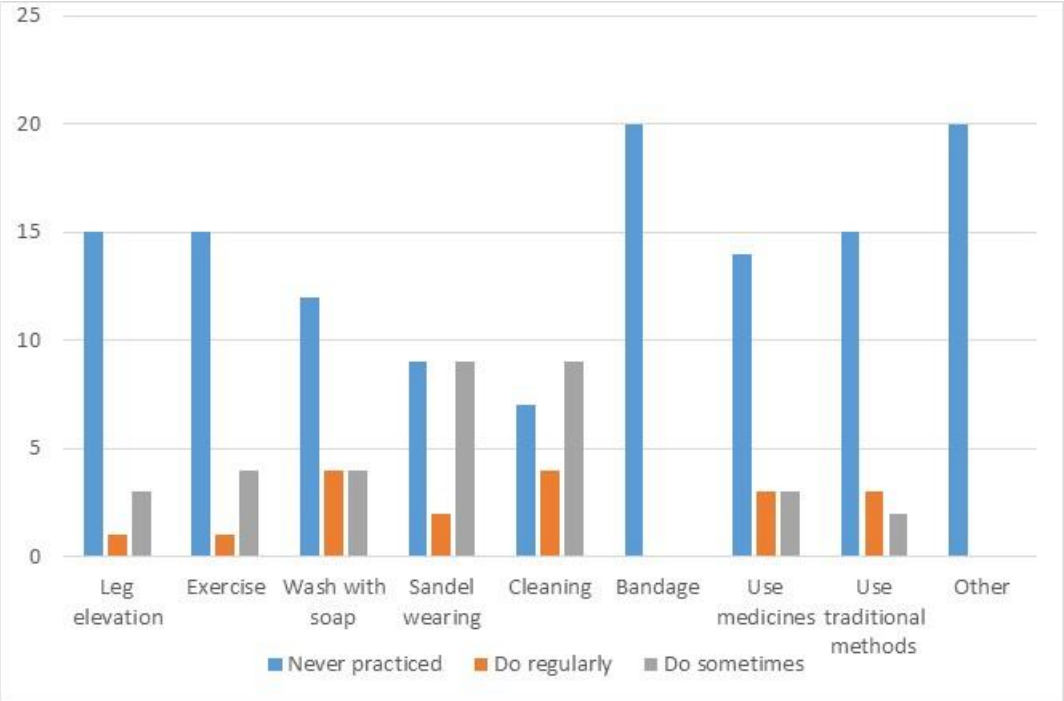
4.3.6 Hydrocele patients

When asking about treatment, all of hydrocele patients stated that they knew about surgical treatment. However, 3 out of 12 (25%) of them have already had surgery. Main reason for not having the operation was related to i) lack of awareness-25%, ii) it is expensive-50% and iii) fear of side effects 8.3%. None of the respondents stated that the reason was related to the lack of a facility in the local centre.

Table 4.4 Morbidity control measures practiced presented as number

Measures practiced	Never practiced	Do regularly	Do sometimes	No response
Leg elevation	15	1	3	7
Exercise	15	1	4	7
Wash with soap	12	4	4	6
Sandel wearing	9	2	9	6
Cleaning	7	4	9	6
Bandage	20			6
Use medicines	14	3	3	6
Use traditional methods	15	3	2	6
Other	20	0	0	6

Figure 4.6 Morbidity control measures practiced presented as proportion



4.4 Discussion

Overall most people have heard of LF and three quarters could name specific symptoms correctly (positive). However, nearly half did not know the type of disease. About one third said it is hereditary disease. Only 10% identified it as an infectious disease. When asked about how it caused approximately half said it is transmitted by mosquito. This suggest that campaign focused on certain aspect of disease and may be the information needs to be expanded (Ramaiah et al, 2011).

Source of information of LF in this study shows similar findings in study in Malaysia KAP study. High proportion of them received information from health workers and a diseased friend and someone from the community (Al Abd et al, 2014). In this study people were able to provide multiple responses. In highly endemic area, obviously people know from diseased friend. Interestingly there was difference between man and women and women mostly getting the information from health workers and male from newspaper, Radio, Television suggest that health massages need to be targeted to different subgroups. Considering the fact massage delivery needs to target the focus group. This may be important for man to encourage for hydrocele surgery with Radio and TV program.

A range of opinion was sorted on aspect of transmission and the possibility of elimination. Overall high proportion of the statement was positive and all correct. However, there was some clear misconception for example approximately a third of surveyed potentially thought that bad air, personal contact and living in the same house can be the cause of LF transmission. Also 20% thought of it is a curse. In contrast many people believed that LF elimination is possible which is a positive and may reflect the successful MDA and public health campaign driven by Bangladesh LF elimination programme which really highlights the elimination possibility. Similar result was found in KAP study in Indonesia (Krentel et al, 2006).

The specific questions to patients with clinical condition highlighted that in addition to LF related condition they are suffered from pain, redness and heaviness (Ramaiah et al. 2013). Although majority has no formal training or no free supplies from Govt, most of them/all practiced cleaning using soap and water, which is an important recommendation from WHO MMDP (WHO_MMDP, 2013). The fact that no one reported bad odour and only one has fever. This suggest that they were managing their condition with basic measures and there were very infrequent episodes of ADLA. Recent reviews and studies showed that these measures are effective preventing ADLA (WHO-MMDP, 2013). However, this study is limited with few number of patients. Further studies can be done on these issues.

Obviously LF patients has difficulty in different aspect of life and we asked only few questions on it. They highlighted range of difficulties such as walking, working, travelling. However, Martindale highlighted that advanced stages are related to more difficulty in walking, travelling in compared to early stage of diseases (Zeldenryk et al, 2011, Zeldenryk et al, 2013, Martindale et al, 2014). However, more in depth study can be conducted about social and economic impact of LF and quality of life.

Most of them are aware about mosquito control and also this study showed that they are aware about mosquito control (Ref- Malaysia study) and they clean the environment and use mosquito net which might have impact on LF and other mosquito borne diseases like malaria, supporting the integrated NTD model (WHO, 2013).

Some misconceptions about the treatment – is that 18% thought that it could be cured by one dose of drug and nearly one third did not know the accurate MDA medicines – this has

implications for the national programme and these populations/ communities need to be targeted.

The main treatment practiced in the affected community is washing, skin care, cleaning which is recommended in WHO MMDP programme, indicating that National LF programme has initiated to focus on morbidity management (WER, 2017).

Different preventive measures are practiced in different areas. For example in some upazila had high MDA as well as bed nets and IRS and other have very low use of mosquito net, may be affected by other mosquito borne diseases program.

Our study was the first KAP survey in South-east Asia to precede a health promotion campaign and MDA and thereafter. The results of round 1 are in line with results from studies in other areas with a different socio-demographic background. More people knew about the main symptoms of LF such as lymphoedema and hydrocele than about the disease name 'filariasis' (Eberhard et al. 1996). Male individuals appear to be more aware of the symptoms, especially hydrocele than females (Babu et al. 2004). In most communities it is not widely known that mosquitoes transmit the disease agent and very fewer individuals know that worms in the blood cause the disease (Eberhard et al. 1996; Babu et al. 2004; Das et al. 2005). Some studies even do not strictly differentiate between vector and disease agent (Ramaiah et al. 1996; Das et al. 2005).

We observed in our study population some interchangeability between transmission and cause of LF. A study from Haiti indicated that knowledge about the symptoms of LF, its transmission and control has a positive impact on the compliance of MDA (Mathieu et al. 2004). This is supported by our results where 89% of the individuals who knew about filariasis and completed the questionnaire also reported participation in MDA. We have established that it is essential to provide the community with basic information about treatment and the possibility of adverse reactions; however, it is also important how the communication campaign is conducted. The KAP survey in round 1 and previous anthropological studies provided the research team with concrete information (Krentel et al., 2006).

4.5 Conclusion

Overall good knowledge of the community – reflects a good LF programme. However, home based morbidity programme is not adequately well understood by the affected people. Even though there are less number of advanced cases, it is crucial to prevent deterioration of their disability by enforcing self-care. They need to be adequately trained for self-care or care by family members or community self-help group where applicable. They need to be aware about referral/seeking help to main stream health services specially for surgery of hydrocele and ADLA management. However, they need to be educated about negative implication of traditional practices like cutting by knife or fish bone. Community self-help group and community leaders can play an important role in this aspect or alleviation of stigma related to long term disability from LF.

Chapter Five

Workload, experiences and perspectives of community health workers

5.1 Introduction

The National LF Elimination Programme commenced in 2001 and has been very successful in the scale up of MDA, reducing prevalence to zero and is now well into the post-MDA surveillance phases (Shamsuzzaman AKM et al., 2017). Along with MDA, morbidity control activities have also been scaled-up gradually in recent years by the LF programme primarily through home-based care programmes. These have been run by community health workers (CHWs), who are also involved in all primary healthcare activities such as immunization campaigns, polio eradication, maternal and child health, malaria and kala-azar control as well as working on NTD programmes.

The CHWs are the first point of contact for health-related issues in the community in Bangladesh. They are a non-professional group of people who have shorter training than professional health workers and can work both in community and health facilities on a paid, voluntary or part-time basis depending on the setting. The main source of paid income may include a salary from the government and/or incentives from non-government organisations (NGOs) for work on primary healthcare activities, and from development partners such as World Bank, USAID, UKAID which are directed through government programmes. The CHWs are trained and supervised by teams at sub-district (upazila) level including the Upazila Health and Family Planning Officer, Medical Officer of Disease Control, and the Upazila Health Inspectors, who have been trained by district health officers and the National LF Elimination Programme team. MMDP training modules are developed from the standard WHO guideline and training materials (WHO 2017, WHO 2013).

The CHWs play a key role in patient care and understanding their potential contributions as well as their challenges may be critical to the success of the MMDP component of the programme (Corley, et al., 2016). The LF Programme included some training on MMDP activities at the same time as the MDA training programme; however, the knowledge and effectiveness of CHWs were not assessed (Hafiz et al., 2012). It is also not known what the

ideal number of visits or how long each CHW should spend with patients as there are currently no recommendations. This study builds on the previous paper by Hafiz et al. (Hafiz et al., 2015) in Nilphamari District, which identified LF morbidity (lymphoedema or hydrocoele) in 4.4% of persons over 10 years of age. Since chronic and stigmatizing disability from LF occurs many years after infection, the highest burden of disease was observed in those over 50 years of age. The overall prevalence of LF morbidity did not differ between males and females, but the type of disease differed since only males can suffer from hydrocele. There were more lymphoedema cases in women (Hafiz et al., 2015).

The current paper provides insights into the workload, experiences and perspectives of male and female CHWs in a highly endemic region of Bangladesh before the scale up of MMDP activities by the National LF Programme in 2013. Although not one of our pre-specified analysis objectives, it became clear during the analysis that there were important differences between men and women in some responses. Therefore, we compared the CHW characteristics by gender as well as other characteristics. The study provides information on the extent of male and female CHW's work in terms of number of patients, frequency of visits, training, knowledge of disease, patient care and advice, and programmatic activities. The study was conducted in 2011 and provides an important baseline for LF programme in which to assess the experiences of CHWs over time as the MMDP component of the programme develops.

5.2 Methods

5.2.1 Study design

A cross-sectional survey was conducted in Nilphamari District, a representative endemic district in the nrthern region of Bangladesh, to examine the male and female CHWs' practice in the control of morbidity, their knowledge of LF disease and their opinion of programmatic activities. Based on the cluster survey areas described in (Hafiz et al., 2015) CHWs were randomly selected from a list within the same catchment area and asked to participate in the survey. None of the CHWs approached refused to be interviewed. The total number of CHWs selected was 61 and thus the sample represents 28.8% of the total of 212 CHWs working in the district. Usually there is one community clinic for 6000 population, covered by one CHW. However, not all communities have their own CHW, and some of the CHWs work for double the population. The district consists administratively of 6 upazilas, 61 unions and 361 villages.

To maintain confidentiality of the health worker respondent, the data were analysed at upazila level (the next administrative level below district) only. A semi-structured questionnaire was implemented with three main themes and a subset of specific questions. The questionnaire was done on paper by an interviewer. The questionnaire was semi-structured in that it contained a mixture of multiple choice, scaled and open-ended answers for which text responses were given. The responses from the open questions concerning the CHWs' work and experiences were presented in the paper as quotations. The questionnaire was pretested in the local community prior to initiating the fieldwork.

The first main theme was related to demographic and workload characteristics, and included questions on;

- demographics (location, sex, age, education, income, religion, marital status)
- work history (length of time in service, length of time in community)
- training (received for morbidity management)
- workload (number of patients in area, number of patients visited in last 6 months, number of times patients visited in last 6 months, length of time spent with patients per visit)

The second theme was related to knowledge of disease, prevention and morbidity management, and included the following;

- knowledge of disease (main signs and symptoms, type of disease, cause of disease, main methods of prevention)
- knowledge of LF programme (time and frequency of MDA, name of drugs distributed)
- patient identification and service (patient diagnosis, provision of patient care)
- morbidity practice (health worker advice, additional measures conducted by patient, support provided by LF Programme)

The third theme was related to opinions of training, morbidity management and programmatic activities, and included questions on

- Training (duration, usefulness, adequate in content, length of time, practicality, suggestion for improvement)

- Morbidity management (allocated time with patients, main causes of insufficient time, effectiveness of programmatic measures, caring for patient with advanced disease, main problems and suggested solutions with provision of care)
- Programmatic activities (elimination potential, participation in MDA programme, coverage rates, reasons for non-compliance)

5.2.2 Data analysis

All data were entered Microsoft Excel Version 12.3.6 (Microsoft corporation, USA) and transferred to IBM SPSS Statistics 21 (IBM corporation, Armonk, NY, USA) for analysis. Cross-tabulations were used to determine the relationship between CHWs' characteristics and their responses. Differences between male and female workers were specifically examined in relation to demographic and workload characteristics, morbidity management advised to patients, and the main problems and solutions related to the provision of care. Comparisons were made by odds ratios (OR) with p-values <0.05 as statistically significant. The CHWs' opinions of their training and morbidity management, from additional open-ended comments, were highlighted by presenting selected quotes that represented the range of opinions put forth.

5.3 Results

5.3.1 Demographic and workload characteristics

In total 61 CHWs across the six upazilas were included in the survey representing approximately two to three health workers for each health catchment area. The number of respondents per upazila varied for Dimla (n=1), Domar (n=6), Jaldhaka (n=13). Kishoregonj (n=5), Sadar (n=21) and Saidpur (n= 15). In total, there were 39 male and 22 female CHWs. The average age was 42 years (Range 22-56 years) with the majority (70.5%) in the 41-50 age-group as shown in figure 6.1.

Male CHWs were three times more likely to be above the average age of 42 years than female health workers (OR=3.22, p=0.045) as shown in table 6.1. Overall, approximately half the respondents had primary or secondary level of education (57.4%) or graduate or higher level of education (42.6%). Average monthly income for CHWs was 12300 Taka (~GB£=112; ~US$=149). There was no significant difference between male and female CHWs by education and income level. Almost all respondents were Islamic (93.4%) and married (96.7%).

Figure 5.1 Age distribution of community health workers by sex

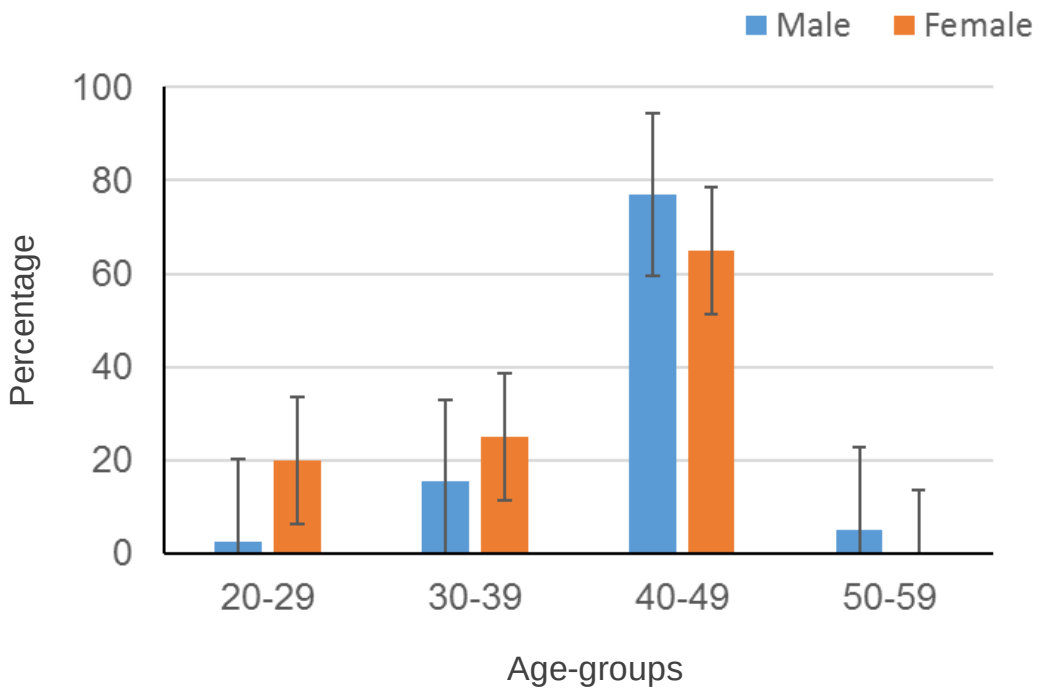


Table 5.1 Summary of demographic and work load characteristics

Characteristics	Total n=61/*59	Male n=39 (%)	Female n=22(%)	OR 95% CI	P value
Age *(n=61)					
>42 years	43	31 (79.5)	12 (54.5)	3.22	
< 42 years	18	8 (20.5)	10 (45.5)	1.03 - 10.14	0.045**
Education level (n=61)					
Graduate	26	17 (43.6)	9 (40.9)	1.12	
Primary / Secondary (HSC)	35	22 (56.4)	13 (59.1)	0.39 – 3.22	0.840
Income (n=61)					
≥ 12300 Taka	39	26 (66.2)	13 (59.1)	1.38	
< 12300 Taka	22	13 (33.3)	9 (40.9)	0.47 – 4.08	0.555
Length of service overall (n=61)					
≥ 19 years	45	32 (82.1)	13 (59.1)	3.16	
<19 years	16	7 (17.9)	9 (40.9)	0.97 – 10.29	0.056
MMDP training received (n=61)					
Yes	57	38 (97.4)	19 (86.4)	6.0	
No	4	1 (2.6)	3 (13.6)	0.58 -61.62	0.132
Number of patients in catchment (n=61)					
≥ 15	23	19 (48.7)	4 (20)	3.8	
< 15	38	20 (51.3)	16 (80)	1.07 – 13.4	0.038**
Number of patients in last 6 months * (n=58)					
≥ 10	22	17 (47.2)	5 (27.8)	2.164	
< 10	36	22 (52.8)	14 (72.2)	0.65 – 7.19	0.208
Patient visit frequency in last 6 months * (n=59)					
> Once	33	21	12	0.778	
Once	26	18	8	0.26 – 2.32	0.653
Average time spent with patients * (n=59)					
≥ 20 mins	32	17 (43.6)	15 (75)	0.258	
< 20mins	27	22 (56.4)	5 (25)	0.08 – 0.85	0.026**
Main location of patient care* (n=59)					
Home only	27	17 (43.6)	10 (50)	0.77	
Home and/or clinic, hospital	32	22 (56.4)	10 (50)	0.26 – 2.28	0.640

* Note that 2 health workers reported no patients so were excluded from these analyses

** $p<0.05$

The average length of time that CHWs were in their health worker position was 19.2 years (range 2 to 33 years), with male CHWs found to have a longer service period than female CHWs (OR=3.16, p=0.056). The time in the current community position was 9.2 years (range 1 to 23 years). The vast majority of CHWs (93.4%) had received some form of training on LF morbidity management, which was similar between males and females (Table 1). The average number of LF patients reported per CHW in their current health catchment area was 15, with male CHWs reporting significantly more patients than female CHWs (OR = 3.8, p value =0.038) (Table 5.1). Two CHWs from Dimla and Jaldhaka upazilas reported no LF patients in their catchment, and therefore were excluded from the analysis related to patients.

In the 6 months prior to the survey, two-thirds of CHWs (62.1%) reported they had visited up to 10 patients, while around one third had visited more than 10 patients (37.9%). The average number of patient visits per month by CHWs was 1.7 times. More than half (56.9%) reported that they visited more than once a month, which was similar between male and female CHWs. The average time respondents reported to spend with each patient during each visit was 20 mins. Overall, more than half of the respondents (55.8%) reported spending more than 20 minutes with each patient, with male CHWs reporting spending less than 20 mins with patients than female CHWs (OR=0.258, P= 0.026).

5.3.2 Knowledge of disease, prevention and morbidity management

The majority of CHWs reported the main signs and symptoms of LF as swelling, fever and/or rash (and combinations thereof) accounting for 83.6% of the responses. Six respondents cited vomiting and diarrhoea, which was not correct. The vast majority (96.7%) identified LF as a parasitic disease, which was transmitted by mosquitoes. When asked about prevention, the majority stated that MDA (80.3%) and/or protection from mosquitoes (93.4%) were the main methods, but two respondents cited vaccination, which was not correct. In response to questions on knowledge of MDA programme 91.8% stated the correct timing and frequency of MDA by LF Programme (November every year), but only 60.7% reported both the correct drugs and doses, which was similar between males and female CHWs

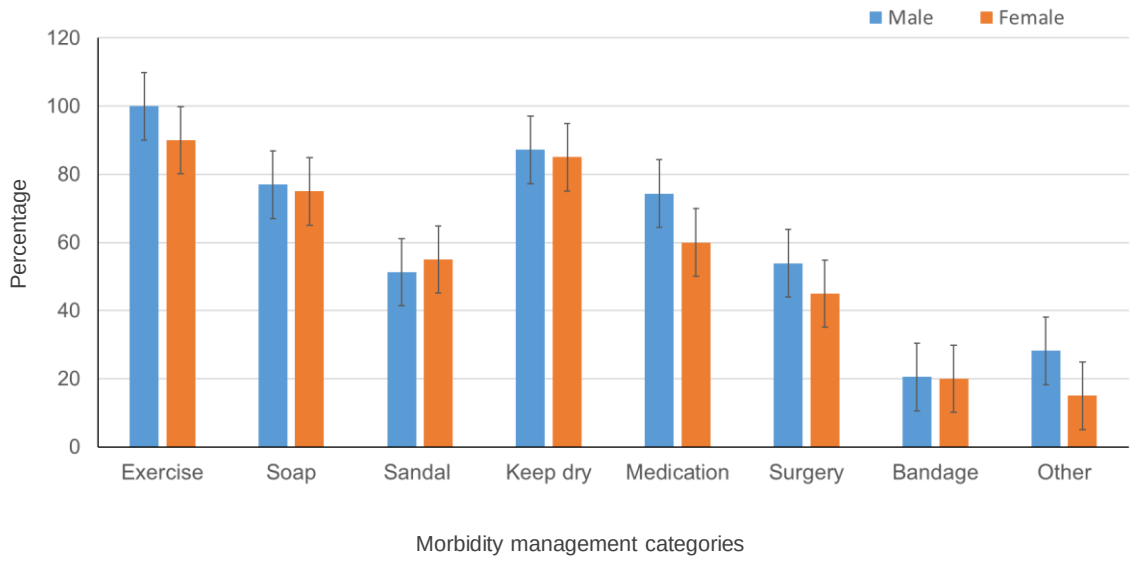
All CHWs reported that they identify patients by their clinical conditions, with four health workers confirming their diagnosis by conducting ICT card test or night blood test to detect microfilaria as part of programmatic activities being conducted in their health facility at the time, and seven health workers by obtaining further expert advice from a medical officer.

Once the diagnosis was confirmed, CHWs provided either home-based care (45.8%) or a combination of home-based management and a referral to a government or private hospital (54.2%), which was similar between male and female CHWs.

The CHWs reported that they advised patients on exercise (96.6%), soap washing (76.3%), keeping the leg dry (86.4%), wearing sandals (52.5%), taking medication (69.5%), using bandage (20.3%), and surgery for men with hydrocoeles (50.8%), with similar patterns of advice given by male and female CHWs as shown in Figure 6.2. When CHWs were asked about what additional measures their patients practiced to get relief from their condition, 24 workers reported that a quarter of the patients reported that they sought treatment from a traditional healer (Palli chikistsha; n=15), used a religious based traditional treatment (Jharfook; n=6), or cut their skin by knife/fish bone or other type of blade (n=3).

The great majority of CHWs (94.9%) reported that the government clinics provided the necessary supplies for patient care free of charge. When asked about what support was provided by the LF programme for patient care, the majority stated that it primarily included a combination of the distribution of kit boxes containing a brochure, soap, antibacterial /antifungal ointment, bandage, cloth, and training of CHWs and supervisors (94.5%).

Figure 5.2 Morbidity management measures advised by community health workers by sex



5.3.3 Opinion on programmatic activities, training and morbidity management

With regards to MMDP training, the duration was reported to be approximately 7.5 hours, and almost all CHWs stated that the training was useful (96.6%). However, when specifically asked about the content, duration and practical sessions, most CHWs found the content to be inadequate (67.8%), the length of time too short (83.3%) with not enough hands-on practical sessions (72.9%). The main suggestion to improve the training was to increase the duration (47.5%) and practical aspects (11.9%).

Selected quotes related to training from individual health workers are as follows;

Quotes

We need more training with practical hands-on demonstrations, as well as access to more supplies. It would also be useful to raise awareness of MDA and morbidity control. (Female Health worker, 47 years)

Proper training for the health worker and adequate counselling for the patients are important for the success of the programme (Male health worker, 46 years)

We need adequate supplies, build awareness, hands-on training, and an incentive for providing morbidity control (Female health worker, 42 years)

Training and refresher training needs to be done twice in a year (Male health worker, 45 years)

It is important to have the involvement of the local community in MDA and to help those people affected by filariasis. Need to increase community awareness and incentive for service provider (Female health worker, 47 years)

Need to improve community participation in training and improve incentive (Male health worker, 41 years)

With regards to caring for patients, half of the CHWs (n=30; 50.8%) stated that the time was insufficient, with the majority reporting that they were too busy (83.3%) or it was not a priority (13.3%). When asked about the measures the LF programme provided (kit boxes and training), most of the CHWs (91.5%) stated these helped to improve the condition of the patient. Specifically, the CHWs reported that they made patients feel better overall (78.0%), reduced their pain (84.7%), frequency of fever and/or ADLAs (42.4%), and the odour of the affected limb (35.6%), and enabled them to work longer (40.0%). When asked about caring for patients with advanced stage lymphoedema, most CHWs reported that it was difficult to

move the limb (71.2%), that patients were unable to wash and dry their limb themselves (72.9%), and that improvements in the condition were slow (74.6%).

Overall, the main problems identified with the provision of morbidity management were the lack of adequate supplies (52.5%), no incentive (17.0%) non-cooperation of patient (6.8%) and the difficulty in following-up with patients (3.4%). However male CHWs reported the lack of adequate supplies for providing care to the patient more of a problem than female CHWs (OR 3.2, p= 0.041) as shown in Table 6.2. The main solutions suggested by the CHWs included more supplies (61.0%), training (44.1%), efforts to increase awareness in the community (55.9%) and combinations thereof, which was similar by male and female CHWs (Table 6.3).

Selected quotes on patient care from individual health workers are as follows;

Quotes

There should be a specialised service for LF patients in local hospitals and it's important to provide good care for poor patients (Male health worker, 45 years)

More support for transport for the patients to go to the health centre is needed (Female health worker, 41 years)

For hydrocoele patients, there is a need to provide good quality care, support for the organisation of surgery and to help reduce the stigmatisation (Male health worker, 43 years)

It is very important to make a list of all patients and to follow-up every month for necessary treatment, advice and medication. Also, some incentive for patients and the health worker provider is needed (Male health worker, 43 years)

Very sick people need more supplies (Male health worker, 45 years)

Because the filarial affected patients cannot walk so far, they need some support to go to the health centre. We also need to conduct vector control and we should provide mosquito nets to the poor patients (Male health worker, 45 years)

With the help of the health worker and after practicing exercises and cleanliness, the patients often feel better to walk and work, and they have a better life (Male health worker, 52 years)

Table 5.2 Main problem identified with the provision of morbidity management

Characteristics	Total N=59	Male n=39 (%)	Female n=20 (%)	OR 95% CI	P value
Lack of adequate supplies for providing care					
Yes	31	24 (61.5)	7 (35.0)	3.2 (1.05-9.74)	0.041**
No	28	15 (38.5)	14 (65.0)		
No incentive					
Yes	10	5 (12.8)	5 (25.0)	0.441 (0.11-1.76)	0.245
No	49	34 (87.2)	15 (75.0)		
Non-cooperation of patient					
Yes	4	2 (5.1)	2 (10.0)	0.487 (0.06-3.74)	0.489
No	55	37 (94.9)	18 (90.0)		
Difficult to follow-up					
Yes	2	0 (0.0)	2 (10.0)	0.09 (0.004-2.05)	0.133
No	57	39 (100)	18 (90.0)		
Other					
Yes	12	8 (20.5)	4 (20.0)	1.03 (0.27-4.0)	0.963
No	47	31 (79.5)	16 (80.0)		

Table 5.3 Main solutions suggested to overcome problems with the provision of morbidity management

Characteristics*	Total N=59	Male n=39 (%)	Female n=20 (%)	OR 95% CI	P value
Adequate supplies					
Yes	36	24 (61.5)	12 (60.0)	1.07 (0.35-3.21)	0.909
No	23	15 (38.5)	8 (40.0)		
Incentives for home-based care					
Yes	9	6 (15.4)	3 (15.0)	1.03 (0.23-4.64)	0.969
No	50	33 (84.6)	17 (85.0)		
Training					
Yes	26	17 (43,6)	9 (45.0)	0.94 (0.319-2.79)	0.917
No	33	22 (56.4)	11 (55.0)		
Programme awareness					
Yes	33	23 (59.0)	10 (50.0)	1.44 (0.486-4.25)	0.511
No	26	16 (41.0)	10 (50.0)		
Other					
Yes	1	1 (2.6)	0 (0.0)	1.6 (0.06 -41.0)	0.777
No	58	38 (97.4)	20 (100)		

With regards to the programme in general, when the health workers were asked about the LF Programme and elimination, the majority (83.3%) completely agreed with the statement "Elimination of filariasis is possible" however, a few health workers (11.5%) said they partially disagreed with this statement (but provided no further comment). With regards to MDA activities, around one third of CHWs helped to supervise the MDA (35.6%) or prepare the reports (30.5%), and stated that most of the community members ingested the drugs. When asked about the reasons for individuals not taking the drugs, the CHWs cited that it was related to the fear of side effects (13.6%), absence from home at time of MDA (5.1%) or a lack of awareness among the community (1.7%).

5.4 Discussion

This study highlights the important work of CHWs in Nilphamari District, a representative endemic region of Bangladesh, providing key insights into their work on LF in terms of number of patients they care for, frequency of and time spent during- home visits, MMDP training, knowledge of the disease, patient care and advice that they provide, and their other programmatic activities and opinions. It provides an important baseline for LF programme in which to assess the experiences and perspectives of CHWs over time as the MMDP component of the programme develops and expands across all endemic districts in the next few years as part the elimination and validation process (WHO, 2017).

In general, the CHWs were mature and experienced, with the majority in the age range of 40-50 years and an average length of service of 19 years. Interestingly, about two thirds of CHWs included in the survey were male, which may differ to other countries where CHWs are predominately female such as in Nepal and Ethiopia and may also have different motivations for being a CHW; however, gender differences are not always specifically examined (Willis-Shattuck M, et al., 2008, Glenton, et al., 2010, Singh D, et al., 2015). The overall workload is an important consideration, and in this current study the CHWs reported an average of 15 LF patients each, whom they visited around twice per month for about 20 mins. Female CHWs reported fewer patients but spent more time with patients than male CHWs. The reason for these unexpected significant differences were not explored here in depth but should be further investigated; they may be related to the level and setting in each of the CHW's work. Given the age and gender specific distribution of LF morbidity, which is most common in those over 50 years of age and differs in presentation by gender, it is also

important to assess whether match between age and gender of the CHWs and the patients is important in quality of care.

The findings indicate that many CHWs already had good knowledge of LF and morbidity management to inform their practice of LF care. This provides a promising foundation on the appropriate knowledge of health workers on filaria, morbidity management, MDA and elimination activities in a highly endemic area of the country. Most CHWs demonstrated that they have appropriate knowledge in identifying filarial cases with standard procedure and suggested the MMDP for their patients as per WHO protocol (WHO, 2013). This contrasts to a study in Ghana, which found relatively low levels of knowledge of health professionals and community members on LF morbidity (Stanton, et al., 2016). Here, this study also highlighted that around one third of the CHWs were also involved in MDA activities, although they could not always state the correct drugs and dose required, which may reflect the time elapsed since MDA and related training.

Training provided for CHWs is a day-long course of about 7.5 hours with some hands-on practice for morbidity management. Most of the CHWs have been trained on morbidity control but they thought that the training was too short, and that the follow-up was not frequent enough. Although the knowledge of these experienced CHWs was good, there is always room for improvement and refresher training is recommended for all CHWs, but especially for new recruits, who may not have a fundamental understanding of LF clinical conditions such as lymphoedema and hydrocele. A study in Malaysia found that untrained CHWs could not demonstrate appropriate knowledge in terms of case identification and morbidity management (AL-Abd, et al., 2014). Systematically and professionally trained CHW are a core component of primary health care systems in low resource settings (Singh, at el., 2015) and it has been shown that well trained CHWs (who work with child health and infectious disease) were significantly better at identifying acute illnesses in children and increase the cure rate of infected patients in Bangladesh. The current study did not investigate the CHW effectiveness, but this would be valuable in future studies.

Considering the pros and cons of the MMDP programme it was found that CHWs are practicing WHO recommended measures such as exercise, elevation, compression, wound and skin care, and suitable footwear (WHO, 2013). This is a good base to work from, however, a third of CHWs also reported that some of their patients practice unhygienic measures like cutting by knife/fish bone, reflecting inappropriate practices as has been noted elsewhere (Odhiambo, et al., 2016). Therefore, it is important to increase effort to investigate any

harmful measures and correct those which may harm the condition. A limitation of this study is that it did not address the patients' practice of MMDP, or their concerns and issues related to this. Further research is needed to explore the patients' issues regarding MMDP. Nevertheless, the role of frontline health workers such as CHWs cannot be underestimated in guiding patients to use safe, effective and quality treatment as emphasised in the WHO Dossier requirements (WHO, 2017).

The CHW is a critical link between the health system and the community members in providing knowledge on effective and ineffective or even harmful practices. Educating staff and teaching them methods of health promotion helps to ensure utilization of local health services for morbidity, and hydrocele surgery in local surgery camps (Stanton et al., 2016). The level of community knowledge was not directly studied here, but has been shown by KAP study to be quite high in Malaysia (Stanton, et al., 2016) whilst another recent KAP study in Nigeria showed that the majority of the community (82%) are not aware about filariasis (Amaechi et al., 2016).

The strengths of this study are that it is one of the few to provide both quantitative and qualitative information by directly interviewing the CHWs, and thus extensively documents the workload, knowledge, attitudes and practices of those actually providing community-based services for home-based management of LF-related morbidity, at baseline before the MMDP programme was scaled-up. A limitation of the study is that the data on average number of patients seen and the time spent with them were based on self-report by the interviewees, and thus could have been biased, perhaps by overreporting to suggest high workload (although there was no incentive to overreport and results were confidential). It was not possible to independently verify these reports in the current study since this would require extensive checking with supervisors or patients, but this would be useful to do in future work.

The inability to spend adequate time and follow-up for on-going patient care were identified as challenges. This finding is comparable with a recent study on health workers in schistosomiasis control in Kenya (Odhiambo et al., 2016). In the current study, the CHWs mentioned that they have other prioritized work, which makes their visits infrequent and allowing them to only spend a short time with LF patients. However, health workers suggested longer training, adequate supplies for patients and spending more time with patients might improve the care. Therefore, the programme needs to focus on the redistribution of workload, prioritizing morbidity, and providing adequate supplies. This is

important in the context of the GPELF, and as the National LF Programme moves towards elimination and needs to meet dossier requirements, which include i) data on number of patients with lymphoedema and hydrocele, and ii) availability of treatment for lymphoedema and hydrocele (Dreyer et al., 2000).

The CHWs are paid according to Government salary structure, with increases given based on length of service and work duration. Only a small proportion of CHWs mentioned incentives, which may be related to working extra hours; however, this was not explored in any detail. However, some other prioritized programmes that they work on do provide financial incentives CHW e.g. immunization, polio eradication, Vitamin A capsule camps, maternal and child health care, malaria control and tuberculosis programmes. A study in Kenya suggested that incentives might improve performance of CHWs (Odhiambo et al., 2016), and other studies elsewhere highlight the CHWs motivations can be multiple and mixed, and vary depending on unique social and economic circumstances (Mpembeni et al., 2015, Burkot et al., 2017). Since CHWs are relatively poor, a study in Bangladesh had shown that more than 80% of CHWs had become a CHW to contribute to the income of their household (Singh et al., 2015). However, non-cash support and other incentives may also be important in the form of supervisory support/appraisals, refresher training, community recognition and supplies for patients, and these may be effective incentives as they have shown to improve morale, social standing, career development, community approval, and patient care in Bangladesh and elsewhere across a range of different health sectors (Willis-Shattuck et al., 2008, Signh et al, 2015, Rahman et al., 2010, Alam et al., 2014).

5.5 Conclusion

Overall, CHWs were well informed on filariasis and the provision of clinical care, indicating a good foundation to work from. However, they indicated that they needed more logistical support, training and supplies for patients, given the long-term care people with LF morbidity require. Insights into their experiences and perspectives helped the LF programme to focus on the specific areas that needed improving to optimise health worker training, adjust gender workload balance, and improve patient care before the start of the large-scale implementation of MMDP activities across endemic areas in 2013.

Chapter Six

Key Themes of Lymphatic Filariasis Control and Elimination

Bangladesh has interrupted LF transmission after a successful MDA programme over the past 15 years. This country is now conducting post-MDA surveillance and will transition to the elimination phase after all endemic districts have completed of TAS in 2018- 2019. Over the next few years as Bangladesh approaches national LF elimination goal, all resources should be mobilized to further tackling the morbidity burden and establish sustainable surveillance systems which are integrated into health systems. The following key themes should be considered for the long-term elimination of LF in Bangladesh and include

i) Environment factors inclusive of housing and interplay with vector control options;

ii) Personal factors that give light on age, gender of patients as well as community health workers;

iii) Adherence and compliance with treatment albeit drugs and morbidity reduction tools;

iv) Household level factors such as co-impact of disease disability in other family members.

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6.1 Environmental factors

The levels of LF endemicity across the country may be related to key environmental factors including demographics, housing structure and mosquito vector species. The highest baseline prevalence rates and case numbers was found in the northern region, Rangpur Division (Shamsuzaman et al, 2017), which is very rural and one of the poorest areas in Bangladesh (BBS, 2011). The high levels of poverty among people in the is region indicate that the infrastructure of housing, health and communities may be less than adequate to protect them from high levels of transmission. As found in other vector-borne disease studies, good housing with closed ceilings, window nets or curtains and other barriers to mosquito bites can reduce the chance of being infected and developing the disease (Haque et al, 2014). In Bangladesh the main LF mosquito is *Culex quinquefasciatus*, which is very prevalent and has adapted well to the human environment, especially areas where there is dirty polluted

water.in poor areas with poor drainage (Stillwaggon, et al, 2016). This makes it difficult to control and the LF programme could aim to improve its public health awareness of this link with the local environment, open housing and drainage system so people are aware how to reduce being bitten and allowing the transmission to return.

Although MDA is effective in interrupting LF transmission, vector control can be a supplementary intervention to block the transmission cycle (Moses et al, 2009). Vector control is one of the strategy to control all vector-borne diseases. In Bangladesh, there are several diseases that are co-endemic, for example malaria and Kalazar. In these areas vector control strategies like insecticide impregnated mosquito net, indoor residual spraying of insecticides are implemented in many endemic districts by malaria control programme (Haque et al, 2014). However, as the *Culex* mosquitoes that transmits LF is different to other vectors in Bangladesh, there is limited opportunity to coordinate or integrate vector control programmes, for example the geographical distribution of LF and malaria do not overlap at all in Bangladesh (Haque et al, 2014). However, it may be possible for some components of the LF elimination programme be integrated with the mainstream malaria control programme, which could extend its work to key LF areas or hotspots (i.e. areas of ongoing transmission). Already there is a wide distribution of mosquito nets outside the malaria endemic areas. This is mainly due to the nuisance biting factor associated with *Culex* and other mosquito species with many people purchasing their own nets. While this study did not examine vector control for LF elimination, the LF programme could better link with the other vector control programmes, to help maintain awareness of the ongoing risks, share public awareness resources and implement targeted control if necessary to help stop transmission in the long-term.

6.2 Personal factors

In additional, it will be important to consider factors related to long-term morbidity management and how the health system can integrate patient care into the existing infrastructure. Personal factors related to age, gender of patients and health workers may be key elements to considered for the long-term sustained reduction in the number of clinical cases and improvement in clinical conditions and patients' quality of life. There is an emerging story of disability and the impact the physical manifestations of LF make on daily activities and participation in community life (Zeldenryk et al., 2011). This study revealed the

gender differences of disability in male and females but did not examine in any detail the impact on day to day activities and social life. This is an important area for further research and something that the GPELF could further support or highlight together with the standard morbidity management activities it promotes (WHO MMDP, 2013).

The most of affected people found in this study were adults and elderly people, who would have been affected for many years or decades. Hydrocele and lymphoedema lead to long-term and permanent disability (WHO, 2013), and as a result would have had a devastating effect on their personal, economic and social life (Stillwaggon economic lymphoedema paper refs). For males, hydrocele is a severe form of disability leading to social stigmatization and physical limitation. For females, lymphoedema, elephantiasis and genital swelling is also associated with shame and taboos, and may make it impossible to get married, which is an essential source of financial and social security in Bangladesh (BBS, 2011. Further research could be done to assess psychosocial impact of permanent disability, and the LF programme should work towards raising awareness of this disease and also engage males and female health workers to help deliver the care to patients.

Given the high number of older male health workers found in this study, it may be more effective if male health workers specifically targeted men with hydrocoele and helped to refer them for surgery. This may help to overcome any stigma or shame associated with the conditions and increase the uptake of surgeries. Currently, the LF programme is having difficulty in scaling up the surgeries across the highly endemic areas, so this could be an important role for male health workers, who seem to be older and therefore may get more respect. Similarly, it may be more appropriate if female health workers focus on female patients to help overcome any barriers or shame in receiving treatment. While this gender-based concept is not ideal and may not be practical everywhere, in some circumstances it may be effective and help reduce the pain and suffering. In rural area women health workers are readily accepted by affected women especially when it involves in private parts. However, this area need to be explored.

In Bangladesh, the morbidity management control programme has been underway since 2013 and primarily involves providing training and refresher training to a variety of health workers, as well as hydrocoele referrals and surgeries, and basic wash kits for lymphoedema management (MOHFW, 2010). However, as this study found, prior to this MMDP work

starting, there were some unhygienic practices being undertaken by patients, though in low numbers. Interestingly, females were most likely to use more traditional healing strategies e.g. Jharfoak, the religious-based traditional healing method which does not use any substances. Several other alternative and potentially dangerous practices were being used like cutting of oedematous leg by knife and fish bone. In spite of available modern medical services in rural areas of Bangladesh, the rural community has more tendency to seek treatment from traditional healers (Haque et al., 2018). Not only for LF, the traditional healing has been widely practiced as the means of primary healthcare in rural areas of Bangladesh, especially among the people with low socioeconomic status. The extent of use of alternative services has shown not to decline with the advancement of modern medical sciences (Haque et al., 2018), which could also have implications for the LF programme. In this context, LF programme needs to focus on maintaining all health care services for LF morbidity control as well as raising awareness of the public about these services to ensure that the patients are aware of and receive the best care possible.

6.3 Adherence and compliance with treatment

Adherence and compliance with treatment is a key to success of LF elimination as highlighted by the WHO (WHO Weekly Epidemiology Report, 2017). This is important for both MDA and MMDP activities. Bangladesh has been successful in getting high drug coverage to the majority of people at risk, enabling the interruption of transmission (Shamsuzzamans et al, 2016), and as a consequence has put the country on track to reach the elimination goal of 2020 (WHO, 2016). However, adherence to morbidity control may be a long-term challenge due to a lack of awareness and motivation for regular self-care if patients do not receive the appropriate training or any continuous supervision. There may also be self-stigma and shame related issues which are barriers for patients. It will be important for the LF programme to maintain adequate training, logistics and supplies or patients so that compliance is maintained. Gender sensitive awareness campaigns may be effective e.g. engaging with local community male leaders, or TV and Radio campaigns for hydrocele surgery while door to door visits for lymphoedema for females.

For lymphoedema management, the best morbidity reduction tools include basic supplies and materials for care e.g. soap, cloths, basin, antifungal cream, appropriate footwear, access to transport, access to health services and knowledge of general and personal hygiene measures (WHO- MMDP, 2018). Perhaps most importantly, it will be essential for patients to

ensure that there is a water supply available.as hygiene is a vital factor for preventing ADLAs and progression of disease. This is a cost- effective method which most patients can afford. Severe cases of lymphoedema sometime require antibiotics to address the localised infections and ADLA impact. There is little literature on the extent to which patients use antibiotics (Stanton et al, 2015, Martindale et al, 2017 Malawi). However, the use of doxycycline is becoming increasing important as it has shown to impact on LF conditions (Mand et al, 2012). A few recent studies explored that people may prefer 8 weeks Doxycycline daily doses than hydrocele surgery. However, there is a question of compliance for 8 weeks medication (Stanton et al, 2016). At present the regular use of doxycycline is not a WHO recommendation, and its large-scale use would need to be monitored carefully, especially for women of child bearing age where felt abnormalities could occur.

6.4 Household factors

The direct economic cost related to the acute and chronic manifestations of LF are a burden on the patient as well as their families, caregivers and the wider community, especially in high burdened areas such as Rangpur Division. There is very little research on the wider impact, especially in relation to families and caregivers. One small study in Malawi found that females were the main caregivers of men with hydrocoele and that their lives were impacted socially and economically, but improved after surgery (Martindale et al, 2017). It is estimated that the cost of treating ADLA episodes ranges from US$ 0.25-1.62, which is almost two days wages in some countries. While the cost of hydrocele surgery, depending on source of care, is estimated to be around US$ 5-60 (Addiss et al., 2007). Economic and social implication of such a high burden with long-term disability has not only physical implication but economic and social implications as it means that people cannot lead productive lives. It affects their mental well-being as well and estimates of mental illness have been recently highlighted in Ton et al. paper (Ton et al, 2015). Overall, men are significantly burdened by hydrocele which may impact on their ability to provide economic support for their family. This has significant implications and a major barrier to getting out of the poverty cycle, and women and children may need to work more to help the family make a living. The economic impact of these conditions needs to be better quantified. Furthermore, the WHO and other researchers suggested that that poverty and NTDs are interrelated (WHO, 2013; Zeldenryk et al.,2013). Therefore, more research needs to be done on the specific issues.

Conclusion

This thesis has highlighted the burden and changing epidemiology of LF, the different aspects of the community knowledge, attitude and practice of LF, and the importance of training and maintaining a health work force to address both transmission and morbidity control in the long-term. This is important and the environment, personal, adherence and household factors should be taken into account, especially as Bangladesh progresses towards the LF elimination goal of 2020.

Chapter Seven

Recommendations

7. Recommendations

7.1 Programmatic recommendations

- To ensure that there are adequate resourced health centres in the most endemic areas of each district with well trained staff for all aspect of lymphoedema care, but also referral system in place specially for hydrocele surgery.
- To ensure that there is specific morbidity management training among health workers to deliver appropriate care to male and female patients and their specific clinical conditions.
- To determine how hydrocoele surgeries can be scaled up to address the immense burden in some communities.
- To ensure that community awareness is maintained, and appropriate materials are supplied to enhance social mobilisation and to help overcome stigma related issues.
- To work to develop health worker curriculums to improve training, including practical hands-on demonstrations of lymphoedema care.
- To establish a simple sustainable method for monitoring the reduction in case numbers over time to ensure that the burden of disease will eventually reduce to zero.
- To determine potential programmatic linkages with different vector-borne disease control programmes to enhance long-term surveillance opportunities.

7.2 Research recommendations

- To determine what are the most important demographic and environmental risk factors associated with the hotspots of disease.
- To follow-up patients from baseline study and determine the impact of MDA and other interventions on their conditions e.g. people with stage 1 lymphoedema in 2005 – did it progress and worsen, or did it stay the same with the introduction of MDA.

- To determine if the cluster survey methods reflects the true burden of disease or if there are other methods to use that may be more cost effective to get disease burden estimates.
- To assess psychosocial impact of permanent disability associated with LF clinical conditions
- To determine impact of clinical disease and disability on the mental health of patients and their families and caregivers, and how this changes as people's conditions improve.
- To determine the roles of community leaders in increasing knowledge of LF and how to encourage them to involve in community awareness programme.
- To understand the stigma related issues of LF and how it may affect the peoples economic and social life.
- To examine the relationship between poverty and disease
- To determine what specific training and specialised knowledge and care is required for severe case management
- To determine if a more gender-based division of care (i.e. male health workers predominately look after male patients and female health worker predominately look after male patients) would improve uptake of surgeries for men and lymphoedema management of all patients
- To better understand and document the alternative practices e.g. cutting/knife, that people use for relief of their condition and the potential damage they may cause.

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Appendices

Appendix I Consent for household survey.

Liverpool School of Tropical Medicine (LSTM), University of Liverpool, UK

Consent form for household survey and knowledge, attitude and practice (KAP) study

Informed Consent

Title of Research: Extent of lymphedema and morbidity management in lymphatic filariasis endemic areas of Bangladesh.

Principal Investigator: Dr Israt Hafiz, PhD student of Liverpool School of Tropical Medicine LSTM, University of Liverpool, UK

Participating Institutes

Centre for Neglected Tropical Diseases, Liverpool School of Tropical Medicine, UK;

Directorate General of Health Services, Ministry of Health and Family Welfare, Bangladesh.

You are being asked to take part in this study because you may be at risk of a disease called lymphatic filariasis (also known as elephantiasis), which can cause swelling in your limbs and other body parts. Before agreeing to participate in this research study, it is important that you read (or someone read for you) the following explanation. Please take your time to make your decision.

Why is the study being done?

The overall aim of this study is to find out how much leg swelling and other signs of Lymphatic Filariasis, people have in areas of Bangladesh. This research will find out the magnitude of problem and knowledge, attitude and current practices of the community to manage the problem. The results will help to plan and design the appropriate ways to control problem of the disease.

Reasons for being selected for the interview?
Since you are a resident of the Lymphatic Filariasis endemic area, we would like to request you to help us by participating in the study.

How many people will take part in the study?
Overall, there will be about 1300 people from 300 households involved in the study from communities of Nilphamari district in Bangladesh. In your community there will be about 10 households and 50 people involved.

What is involved in the study?
There are two parts of the study. These are:
i) Morbidity/clinical [and infection] survey

ii) Knowledge, attitude and practice (KAP) household survey.

1. The morbidity survey will help to detect filariasis affected people with swollen leg, arm, scrotum and with other parts of body severely affected. We will examine you and family members so we can see how many people are affected. If you have any clinical disease, we would also like photograph it (with your permission) for our records.
2. About 50% of population will be tested to see infection. If your household is selected, your blood will be tested for infection. We will test for infection with rapid ICT card test by taking a few drops of blood by finger prick. This ICT test does not tell us if you have a current infection, so if you show positive, we will do another test to detect if the filaria worms are in your blood. This test is called a microfilaria (mf) test, which will need to done at night and will also involve taking a small drop of blood from your finger. The reason why we have to do this test is because the filaria worms are active at night and can only be detected after 10pm. It is important to do as it shows if you have a current infection. This test will be done once, and if positive, you will be offered standard drug treatment and information on preventive measures.
3. All people who will have any swelling in legs, arms, breast & genitalia, will be asked to participate in a knowledge, attitude and current practices study about the filariasis, its problem and how to solve/manage the problem. In absence of patients with swelling a caregiver (If there is any) will be asked to participate in this part of study.

How long will you/your family be involved in the study?
The whole study will last for two years; however, the part that you are involved in will take about half an hour to complete the surveys.

What are the risks of the study?
The risk from participation in this study is very minimal. Finger prick to test filaraisis infection may cause transient pain which will be well tolerated by all. To reduce the risk all aseptic measures will be taken and standard operative procedure will be practiced.

What are the benefits of the study?

Overall, the study will show the current status of disease burden of swelling of legs, arms and genitalia. It will also identify the knowledge, attitude and perception on management of the problem which will help to design the future program suitable for the community.

What are the incentives?
You will not be provided any incentive to take part in the research.

What about confidentiality?
Your name and other personal data from the study will remain confidential. Only a code number will be used during data entry. The overall results will be published for scientific purposes. The participants' identity will not be revealed. Only researchers from the study will have access to the study data. All study results and information will be kept in a secure location of PhD project office. For computer copy, a password will be used to secure confidentiality.

What are the costs?
There will be no costs for participating in the research. To manage the study, all required logistics will be provided free of cost. There will be no personal investment except participating in the study.

Right to refuse or withdraw
Your participation is entirely voluntary. You may withdraw from this study any time without any hassle or loss of benefits.

Who do you contact if you have a question or problem?
Dr Israt Hafiz, Technical consultant, Filariasis Elimination Program, DGHS, Dhaka, Bangladesh Telephone 88 01552415070, 88 02 9354138 and the Chairperson, Bangladesh Medical Research Council (BMRC), Mohakhali, Dhaka. Bangladesh

Do you agree to participate? Yes [ ] No [ ]
I acknowledge that this consent form has been fully explained to me in a language that I understand and I agree to participate in the following parts of the study.

- ☐ Morbidity survey for lymphodema (clinical examination)
- ☐ Household survey (KAP)
- ☐ Infection survey (ICT/Mf)

Participant's name:

_____

Participant's signature (or thumb print):_____ Date: ___/___/___

(or legal guardian if participant is a minor – note relationship). _____

Name and signature of witness

_____Date:___/__ _/__

Printed name of person obtaining Consent

_____

Signature of person obtaining consent

Date: ___/___/___

(Must be study investigator or individual who has been designated to obtain consent)

Appendix ii – part a: Case record form to determine the clinical cases with stages

Interviewer code |__|__|

Upazila _____ |__|__|__|__|
Village _____ |__|__|__|__| House Number |__|__|
Code of House_____ |__|__|__|

1. Name of head of household: .....2. No of Family members.....
3. Marital status……
4. .Average monthly expenditure……..

CHECK ALL THAT APPLY

List of family members (≥ 10 yrs old) with details of affected part of lymphedema:

Sl no.	Code Number	Name	Age (yr)	Sex M-00, F-01	Leg		Arm		Hydrocele (i-ii)**	Breast	Genital organ	Combination	Stage (i-vii)*		ICT test result 00-+ve, 01--ve	Mf in night blood sample 00-+ve,01--ve
					R	L	R	L					R	L		
1.																
2.																
3.																
4.																
5.																

*Stages of leg swelling

** Stages of Hydrocele

Appendix iii- part b. Questionnaire to determine the stage of lymphedema

Name:

Code number:

(Dreyer staging of lymphedema)

Clinical questions for lymphedema patients				
	Left leg		Right leg	
1.What is the stages of Lymphoedema				
Is swelling reversible over night? (reversible swelling; disappear spontaneously overnight)	Y	N	Y	N
Are there shallow skin folds? (base of fold is visible when patient moves the legs)	Y	N	Y	N
Are knobs present? (knobs, humps, lamp or protrusions of skin)	Y	N	Y	N
Are there deep skin folds? (base of fold is visible when separated by hands)	Y	N	Y	N
Are mossy lesion present? (mossy lesion; cluster of small growth on the skin with wart like appearance usually on foot)	Y	N	Y	N
2. Drayer stage of lymphedema (using staging chart and features from above) # Left leg= # Right leg=	Y	N	Y	N
3. Is patient having acute attack currently? (acute attack or filarial fever; episodes of acute inflammation, pain, redness and swelling in limb with associated lymph nodes (Kernals) ague and fever	Y	N		
4. How many acute attacks have occurred in past 6 months? None 1 2 3 4 5 >5				
4a. How long do the acute attack usually last? 1 2 3 4 5 6 7 > 7 days				
5. Are there 'entry lesions' present at any site on the foot? (entry lesion; break in surface of skin; these may be round, ulcer, cracks or sores)				
6. Are interdigital lesions present? (interdigital lesion; abnormal skin in web space between toes; this can be saggy skin or scaly skin) Left foot 4 3 2 1 Right foot 1 2 3 4	Y	N		
7. Nature of interdigital lesion Is skin scaling? (scaling; skin is dry with	Y	N		

superficial scale) Is skin peeling? (peeling; surface of skin peeling away) Is skin cracking? (cracking; breaks in skin surface) Is skin macerated? (0macerated; area is moist and erosive) Is there a bad odor? Is area painful? Is area itchy?	Y Y Y Y Y Y	N N N N N N		
8. Color of lesions? (order; fresh colored, white, other color, please specify.....				
9. Are any nails dystrophic? (dystrophic nails; thickened and/or discoloured) Circle nail that are abnormal Left foot Right foot 5 4 3 2 1 1 2 3 4 5	Y	N		

Extra

notes/comments:_____

Grading or staging of lymphedema legs

(A) Stage 2, swelling that is not reversible overnight.
(B) Stage 3, shallow skin folds at the ankle.
(C) Stage 4, alteration of skin texture and formation of knobs (arrowheads).
(D) Stage 5, presentation of deep skin folds in addition to the alterations of stage 4;
(E) Stage 6, presentation of mossy lesion in addition to the alterations of stage 5.
(F) Stage 7, inability of patient to perform daily work.
Picture demonstrating Dreyer staging:

(Source Dreyer et al, 2000)

Thank you very much for your cooperation

Appendix iv. Questionnaire for KAP study on lymphatic filariasis and morbidity management

KAP study on lymphatic filariasis morbidity

Interviewer |__|__| District _____ |__|__|

Upazila _____ |__|__|__|__|

Village _____ |__|__|__|__|

Household Code Number _____ |__|__|__|

Individual Code Number _____ |__|__|__|

CHECK ALL THAT APPLY

Q No.	**Question**	**Answer**	**Response**
1	**Sociodemographic information**		|__|__|
1.1	Sex	0-Male 1-Female	|__|__|
1.2	How old are you?	..... years	|__|__|
1.3	What do you do (Occupation)?	00-Agriculture 01-Service 02-Business 03-Day labour 04-skilled labour 05-Housewife 06-Student 88-Other	|__|__| …… ……
1.4	At which level you have completed your education?	Completed year of education 01- Illiterate/no school …….. 02- Non formal 03- Other, Please specify……	|__|__| …… ……
1.5	Religion	00-Islam 01- Buddhism 02- Hinduism 03-Christianism 88-Other, Please specify …….	|__|__|
1.6	Tell me about your marital status?	00-Unmarried 01-Married 02- Divorced 03-Widow	|__|__|

		88-Other……	
2	**KAP on morbidity**		
2.1	Have you heard of lymphatic filariasis (or 'Goad Roag')?	00-No 01-Yes	|__|__|
2.2	From where did you know about Filariasis	Media No-0 Yes-1 Health assistant Doctor Radio TV Newspaper Friends/Neighbour Folder Miking	
2.3	What type of disease Filarias is ?	1. Infectious 2. 1-Hereditary 3. Tumerous/cancerous 4. From bad air 88- Other, Please specify 90- Don't know	|__|__|
2.4	What are the main symptoms?	Symptoms No-0 Yes-1 Pain Fever Articaria Vomiting/Diarrhoea Gradual swelling of body parts 88-Other, Please specify 90-Don't know	
2.5	How is it transmitted from one person to another?	00- Food/ water 01- Personal contact 02- Mosquito bite 03-Cough 88-Other please specify…….. 90- Don't know	|__|__|
I will ask some questions about Filariasis where different people have different opinion. I want to know your opinion			
2.6	'Filariasis is spread by personal contact'- What is your opinion on this?	0-completely agree 1-partialy agree 2-partialy disagree 3-completely disagree 90-Don't know	|__|__|

2.7	Filariasis is a result of curse ?	0-completely agree 1-partialy agree 2-partialy disagree 3-completely disagree 90-Don't know	|__|__|
2.8	Filariasis is transmitted to other staying in same house.	0-completely agree 1-partialy agree 2-partialy disagree 3-completely disagree 90-Don't know	|__|__|
2.9	Filariasis is caused by bad air.	0-completely agree 1-partialy agree 2-partialy disagree 3-completely disagree 90-Don't know	|__|__|
2.10	Filariasis is a curable disease.	0-completely agree 1-partialy agree 2-partialy disagree 3-completely disagree 90-Don't know	|__|__|
2.11	It can be prevented by vaccination.	0-completely agree 1-partialy agree 2-partialy disagree 3-completely disagree 90-Don't know	|__|__|
2.12	Elimination of Filariasis is possible.	0-completely agree 1-partialy agree 2-partialy disagree 3-completely disagree 90-Don't know	|__|__|
2.13	Is there anybody in your house who have swollen legs/scrotum/breast/genitalia (lymphedema)?	00-No 01-Yes	|__|__|
2.14	What do you know about management of this disease?	0-taking medicine once ina year for subsequent 5 years 1-Taking medicine once in a year is enough 2-It is not curable by treatment 88- Other, please specify 90-Don't know	|__|__|
2.15	From where you get treatment?	0-Health Assistant gives medicines at home 1. Local health centre 2. Private hospital 3. Community clinic 88- Other, Please specify… 90-Don't know	|__|__|

2.16	How do you get medicine ?	1. Govt supplies free of cost. 2. Buy yourself 88-Other, please specify..	|__|__|
2.17	How do you think the occurrence of the condition (filariasis) could be prevented?	Preventive measures No-0 Yes-1 Taking yearly medicine distributed to the community by health worker By protecting from mosquito bite Take medicine from clinic/hospital -By vaccination 88-Other please specify …….. 90-Don't know -	|__|__|
2.18	What preventive measures were taken in your area?	Preventive measures No-0 Yes-1 Distributing yearly medicine to the community by the health workers Protection from mosquito bite Using mosquito net Insecticide for mosquito Vaccination 88-Other please specify …….. 90-Don't know	
2.19	During the last 5 years, how many times did you take the medicine distributed in the village?		|__|__|
2.20	Why did you take medicine?	1. HA advised to take medicine 2. Doctor advised 3. Convinced by camping of Radio/TV 4. Aware of prevention of disease 5. Concern about spreading of disease 6. For prevention of disease in future generation 90- Don't know	|__|__|

2.21	Had you have any problem after taking medicines?	00-No 01-Yes	|__|__|
2.22	If faced problem, what type of side effects had you have?	Side effects No-0 Yes-1 Itching Articaria (rash) Pain in abdomen Nausea Diarrhoea 88-Other, please specify	|__|__|
2.23	If not taken medicine, what are the reasons for not taking the medicine?	00-Don't get medicine 01-Absent at home during drug distribution 02-Fear of side effects 03-Don't know why they should take drug/lack of awareness 88-Other…….. 89-.None	|__|__|
2.24	From where you know about distribution of medicine?	0-Folder/Leaflet/Poster 1-HA 2-Radio 3-TV 4-Newspaper 5-Friends 6-Miking 88-Other, Please specify	|__|__|
2.25	Do you take any measures to protect yourself from mosquito bite?	00-No 01-Yes	|__|__|
2.26	If yes, what are the measures do you use?	Protection from mosquito bite No-0 Yes-1 Mosquito/ bed net Coil Spray Electrical coil/measures To clean surrounding 88- Other, please specify.. 90-Don't know	
2.27	Do you have mosquito net?	00-No 01-Yes	|__|__|
2.28	If yes, do you always sleep under mosquito net?	00-No 01-Yes	|__|__|

2.29	Anyone else in the house does sleep under the mosquito net?	00-No 01-Yes	|__|__|
Applicable for patient only			
3.1	What are the problems do you feel other than swelling ?	Problems No-0 Yes-1 Pain Redness of affected limb Bad odor 88-Other, please specify 89-none	|__|__|
3.2	What are the problems do you feel due to swelling	Problems No-0 Yes-1 Look odd Feel heaviness Difficulty in walking Feeling sad/depressed Social stigma/nobody want to talk to me 88-Other, please specify 89-none	
3.3	Have you faced any social problem for this?	1. Divorce 2. Separated 3. Isolation 88- Other 89- None	|__|__|
3.4	Do you feel any difficulty to do household activities with swollen parts ?	00-No 01-Yes 02-can't understand	|__|__|
3.5	Do you feel any difficulty to move around with swollen parts ?	00-No 01-Yes 02-can't understand	|__|__|
3.6	Do you feel difficulty to work in workplace with this condition?	00-No 01-Yes	|__|__|
3.7	What measures are you practicing to get relief from your health condition (filariasis)?	Measures taken Never-0 Do regularly-1 Do sometimes Leg elevation	|__|__|

		Exercise Wash with soap Sandel Cleaning Bandage Use medicine 88-Other 89- none	
3.8	What type of problem do you face?	01-Work fewer hours/reduced activities 02-Not able to do certain kind of activities/Not able to do heavy work 03- Stop or change the occupation 04-Not able to work at all 88- other	|__|__|
3.9	Are you taking any other measures without advise of doctors /HA ?	00-Cutting with knife/fish bone 01- Jhar-foak 02-Local traditional measures by Gipsy 88-Other, please specify……. 89-.None	|__|__|
3.10	How long are you using the measure?		|__|__| Month
3.11	Are these measures helpful for you ? How much improvement did you notice ?	0-No improvement at all 1-A little bit improvement 2-Overall improvement 3-Improved a lot	|__|__|
3.12	What type of improvement did you notice by practicing these measures?	Improvements No-0 Yes-1 It improves working hours per day Reduce swelling Relief pain Reduce frequency of fever/Acute episodes Leg or affected organ remains clean/odourless Overall, feels better No relief 88-other……. 89-.None	
3.13	How easy or difficult to practice these measures?	00-Very easy 01-Somewhat easy 02-Somewhat difficult 03- Very difficult 90-Don't know	|__|__|

3.14	Have you had any training from health staff to manage your swollen limb?	00-No 01-Yes	|__|__|
3.15	What supplies were given to you for your condition from Government?	00-Brochure 01-Soap 02-Ointment 03-Bandage cloth 88-Other…….. 89-None	|__|__|
3.16	Do you find these things are useful for you?	00-Useful 01- Not useful 02-Don't like 03-Don't know how to use 04-Better to buy yourself	|__|__|
3.17	Do you know about free Medicine distribution by government in your community? If answer is 'No', go to Q 2.17	00-No 01-Yes	|__|__|
Applicable for Hydrocele patient			
3.18	Do you know about the treatment for hydrocele?	00-No treatment 01-Surgical treatment 90- Don't know	|__|__|
3.19	In case of scrotal swelling have you undergone surgery for hydrocele? (patient with scrotal swelling only)	00-No 01-Yes	|__|__|
3.20	If not, why don't you take surgical treatment ?	0-fear of side effect 1-Lack of awareness 2-no facility at local centre 3-Expansive 88-Other 89- none	|__|__|

Thank you very much

****

Appendix v: Questionnaire to assess the extent of work of community health workers and their management of LF patient.

Liverpool School of Tropical Medicine (LSTM), University of Liverpool, UK

Title of Study: Extent of lymphedema and morbidity management in a lymphatic filariasis endemic area of Bangladesh

Appendix 5

Questionnaire for Community Health Workers (CHW)

Interviewer |__|__| Upazila _____ |__|__|__|__|

Code number of service provider _____ |__|__|__|

CHECK ALL THAT APPLY

Q No.	**Question**	**Answer**	**Response**
1	**General information**		
1.1	Sex	01- Male 02- Female	|__|__|
1.2	How old are you?	..... years	|__|__|
1.3	At which level you have completed your education?	00-Primary 01-SSC 02-HSC 03-Graduate 04-Postgraduate 05-Vocational 06-Iliterate 88-Other	|__|__|
1.4	Religion	00-Islam 02- Buddhism 03- Hindu 04-Cristian 88-others	|__|__|
1.5	Marital status	00- Single 01- Married 02- Separated 03- Divorced 04- Widow……	|__|__|
1.6	Monthly expenditure of households (taka)	……. ……..	|__|__|

<table>
<tr><td>1.7</td><td>How long have you been working (months) in this job?</td><td></td><td>|__|__|</td></tr>
<tr><td>1.8</td><td>How long have you been working in this community?</td><td></td><td>|__|__|</td></tr>
<tr><td>2</td><td colspan="3">Questions related to lymphatic filariasis morbidity management</td></tr>
<tr><td>2.1</td><td>How many patients do you have in your working area?</td><td></td><td>|__|__|</td></tr>
<tr><td>2.2</td><td>How did you diagnose them as filaria patients?</td><td>
<table>
<tr><td>Process of identify</td><td>No-0</td><td>Yes-1</td></tr>
<tr><td>Identifying symptoms</td><td></td><td></td></tr>
<tr><td>Night blood test</td><td></td><td></td></tr>
<tr><td>ICT card test</td><td></td><td></td></tr>
<tr><td>According to Dr’s diagnosis</td><td></td><td></td></tr>
<tr><td>Other</td><td></td><td></td></tr>
</table>
</td><td></td></tr>
<tr><td>2.3</td><td>What are the main symptoms of this disease?</td><td>
<table>
<tr><td>Symptoms</td><td>No-0</td><td>Yes-1</td></tr>
<tr><td>Fever</td><td></td><td></td></tr>
<tr><td>Rashes on body</td><td></td><td></td></tr>
<tr><td>Vomiting & Diarrhoea</td><td></td><td></td></tr>
<tr><td>Gradual swelling of different parts of body</td><td></td><td></td></tr>
<tr><td>88- Other</td><td></td><td></td></tr>
<tr><td>90- don’t know</td><td></td><td></td></tr>
</table>
</td><td></td></tr>
<tr><td>2.4</td><td>What type of disease is it?</td><td>00-Parasitic
01-From bad air
02-bacteria borne
88-Other ……..
90-Don’t know</td><td></td></tr>
<tr><td>2.5</td><td>What causes lymphatic filariasis?</td><td>00- Food/ water
01- Personal contact
02- Mosquito bite
03-Cough
88-Other……..
90- Don’t know</td><td>|__|__|</td></tr>
<tr><td>2.6</td><td>What do you do for patents after diagnosis?</td><td>00-advice to care affected limbs at home
01-refer to govt hospital for care
02- refer to private hospital for care
88-Other</td><td>|__|__|</td></tr>
</table>

<table>
<tr><td></td><td></td><td>90- Don’t know</td><td></td></tr>
<tr><td>2.7</td><td>Where do you give care for patients?</td><td>00- At home
01- Govt Hospital
02- Community clinic
03- Non govt health centre
88-Other</td><td>|__|__|</td></tr>
<tr><td>2.8</td><td>For mobidity management have you got any training?</td><td>00-No
01-Yes</td><td>|__|__|</td></tr>
<tr><td>2.9</td><td>If yes, how did you find the content of your training for work?</td><td>00-Inadequate
01-Adequate
03-Very detail</td><td>|__|__|</td></tr>
<tr><td>2.10</td><td>How was the duration of training?</td><td>00-Very short
01-short
02-Appropriate
03-seems longer than needed</td><td>|__|__|</td></tr>
<tr><td>2.11</td><td>Was there adequate hands on training?</td><td>00-enough
01-not at all
02-more than requirement</td><td>|__|__|</td></tr>
<tr><td>2.12</td><td>Utilization of training in your work?</td><td>00-very helpful
01-helpful
02-not helpful at all</td><td>|__|__|</td></tr>
<tr><td>2.13</td><td>Any suggestion regarding improvement of training?</td><td>00-increase duration of training
01-strenghtenng hands on training
88- Other
90- Don’t know</td><td>|__|__|</td></tr>
<tr><td>2.14</td><td>What measures are you using to manage their condition?</td><td><table><tr><td>Services</td><td>No-00</td><td>Yes-01</td></tr><tr><td>Exercise regularly</td><td></td><td></td></tr><tr><td>Soap washing</td><td></td><td></td></tr><tr><td>Wearing sandals</td><td></td><td></td></tr><tr><td>Keeping leg Clean and dry</td><td></td><td></td></tr><tr><td>Bandages/Compression with clothes</td><td></td><td></td></tr><tr><td>Surgical (in case of testes swelling)</td><td></td><td></td></tr><tr><td>Medicines</td><td></td><td></td></tr></table></td><td></td></tr>
<tr><td>2.15</td><td>What other measures do people practice other than your suggesion to get relief from health condition (filariasis)?</td><td>00-Cutting with knife/fish bone
01-Alternate/traditional herbal treatment
02-Jhar-foak
03-traditional method by “Oja”
88-Other
89-None</td><td>|__|__|</td></tr>
<tr><td>2.16</td><td>What are the services do you provide for Hydrocele?</td><td><table><tr><td>Services</td><td>No-0</td><td>Yes-1</td></tr><tr><td>Suggestion for operation</td><td></td><td></td></tr></table></td><td></td></tr>
</table>

		Care at home	
		Follow up after surgery	
		88-Other	
		89- None	
2.17	Have you found the measures suggested by national programme, improved the condition of patient?	00-No improvement 01-Improvement 02-Deteriorate the condition	|__|__|
2.18	If yes, what kind of relief does the patient get by practicing these measures?	Improvements (No-00 / Yes-01)	
		Reduce pain	
		Able to work for longer time	
		Frequency of fever/ADL episodes decreases	
		No foul smell from affected limb	
		Feel better overall	
		88-Other	
		89- None	
2.19	How do you find caring for patients with advanced stages of disease?	Experiences (No-00 / Yes-01)	
		Difficult to move the affected limb, so cannot do exercise	
		They can't wash/dry by themselves in most cases.	
		Improvement is slow.	
		No improvement at all.	
		88-Other……	
2.20	How many patients have you helped with morbidity control during last 6 months?		|__|__|
2.21	How many times do you visit a patient in a month (on average)		|__|__|

<table>
<tr><td>2.22</td><td>How much time could you spend for one patient on average?</td><td></td><td>|__|__|</td></tr>
<tr><td>2.23</td><td>Do you think the allocated time for this patient is enough for services?</td><td>00-No
01- Yes</td><td>|__|__|</td></tr>
<tr><td>2.24</td><td>If Ans of 2.23 is no, What are the main cause of not giving enough time?</td><td>00- You are too busy with other activities eg EPI
01-It is not your prioritize work
02-It is not seems to be helpful for patients
03- Lack of awareness
88-Other……..
89-.None</td><td>|__|__|</td></tr>
<tr><td>2.25</td><td>If you don’t provide services , from where they can get services</td><td>0-Hospital
1- NGO
2-Friends or relatives
88-Other</td><td>|__|__|</td></tr>
<tr><td>2.26</td><td>From where you get necessary supplies for providing care?</td><td>00- from Govt/free
01- Patients collect by themselves
02- No supplies
88- other
90-don’t know</td><td>|__|__|</td></tr>
<tr><td>2.27</td><td>What supports are provided by national LF elimination programme for patient?</td><td><table><tr><th>Supports</th><th>No-0</th><th>Yes-1</th></tr><tr><td>Distribution kit boxes containing brochure, soap, antibacterial /antifungal ointment, bandage, cloth etc</td><td></td><td></td></tr><tr><td>Training for community service provider</td><td></td><td></td></tr><tr><td>Training for supervisors</td><td></td><td></td></tr><tr><td>88-Other…….</td><td></td><td></td></tr></table></td><td>|__|__|</td></tr>
<tr><td>2.28</td><td>How helpful the kit box contents for patients</td><td>0- Useful
1- Not useful
2- Patients don’t like
3- They know the use of content of kit box
4- Patient are able to buy
88-other</td><td>|__|__|</td></tr>
<tr><td>2.29</td><td>What do you know about the prevention of diseases?</td><td><table><tr><th>Prevention</th><th>No-0</th><th>Yes-1</th></tr><tr><td>0-MDA</td><td></td><td></td></tr><tr><td>1-Vaccination</td><td></td><td></td></tr><tr><td>2-Prevention of mosquito bite</td><td></td><td></td></tr><tr><td>88-Other…….</td><td></td><td></td></tr><tr><td>89-Don’t know</td><td></td><td></td></tr></table></td><td></td></tr>
</table>

<table>
<tr><td>2.30</td><td>When Mass Drug Administration (MDA) is conducted?</td><td>00- November
01-May
02-Any time in the year
88-Other
90-Don’t know</td><td>|__|__|</td></tr>
<tr><td>2.31</td><td>Do you know how many times MDA is conducted in a year?</td><td>00- one time
01-two times
02-no fix turn
88- other
90-don’t know</td><td>|__|__|</td></tr>
<tr><td>2.32</td><td>Which medicines are distributed during MDA</td><td>00- 1 tab Albendazole & 1 tab DEC
01- 1 tab Albendazole & DEC 1-3 tab according to age
02- only DEC
03- only Albendazole
88- other
90- don’t know</td><td>|__|__|</td></tr>
<tr><td>2.33</td><td>There is MDA for Filaria elimination every year. How do you participate in the programme?</td><td><table><tr><td>MDA activities</td><td>No-0</td><td>Yes-1</td></tr><tr><td>Administer drug in every house</td><td></td><td></td></tr><tr><td>Supervise drug administration</td><td></td><td></td></tr><tr><td>Conduct community awareness prior to drug administration</td><td></td><td></td></tr><tr><td>Prepare report of drug administration</td><td></td><td></td></tr><tr><td>88-Other……</td><td></td><td></td></tr><tr><td>89- None</td><td></td><td></td></tr></table></td><td></td></tr>
<tr><td>2.34</td><td>Do the people take medication during MDA?</td><td>00-very few people take medicines
01-Most of the people take medicines
02-Almost all take medicines</td><td></td></tr>
<tr><td>2.35</td><td>If not taken medicine, what are the reasons for not taking the medicine?</td><td>00- Absent at home during drug distribution
01- Don’t know why they should take drug/ not explained by drug distributor
02- lack of awareness
03- Fear of side effects
88-Other……..
89-.None</td><td>|__|__|</td></tr>
<tr><td colspan="4">Now I will ask some questions where different people have different opinion. Please let us know your opinion.</td></tr>
<tr><td>3.1</td><td>Filariasis is a not curable disease.</td><td>00-completely agree
01-partialy agree
02-partialy disagree
03-completely disagree
90-Don’t know</td><td>|__|__|</td></tr>
</table>

3.2	It can be prevented by vaccination.	00-completely agree 01-partialy agree 02-partialy disagree 03-completely disagree 90-Don't know	|__|__|
3.3	Elimination of Filariasis is possible.	00-completely agree 01-partialy agree 02-partialy disagree 03-completely disagree 90-Don't know	|__|__|
3.4	What are the problems you face during providing morbidity control?	00-inadequate cooperation from patients 01- Home based programme is difficult to follow up 02-No adequate supplies of logistics 03-People are not motivated about treatment 04- lack of incentives for home based program 88-Other…… 89-None	|__|__|
3.5	What are your suggestion to overcome problems?	00-Provide adequate supplies for patient 01-Need incentive for service provider for home based service 02- Need training 03-Need awareness programme 04- no incentive (career) 88-Other …… 89-.None	|__|__|

Extra notes/comments:_____

Thank you very much for your cooperation

Appendix vi: Publication related to thesis and NTDs.

Thesis related

1. **Clinical case estimates of lymphatic filariasis in an endemic district of Bangladesh after a decade of mass drug administration**. 2015. **Hafiz I**, Graves P, Haq R, Flora MS, Kelly-Hope LA. Trans R Soc Trop Med Hyg. 109(11):700-9

2. Workload, experiences and perspectives of community health workers on morbidity management of lymphatic filariasis in an endemic district of Bangladesh. 2018. Hafiz I, Flora MS, Haq R, Graves P, Kelly-Hope LA. *(Under review)*

NTD related

3. School-based mass distributions of mebendazole to control soil-transmitted helminthiasis in the Munshiganj and Lakshmipur districts of Bangladesh: an evaluation of the treatment monitoring process and knowledge, attitudes, and practices of the population. 2015. **Hafiz I**, Berhan M, Keller A, Haq R, Chesnaye N, Koporc K, Rahman M, Rahman S, Mathieu E. Acta Trop. 141(Pt B):385-90.

4. Developing the first national database and map of lymphatic filariasis clinical cases in Bangladesh 2018. Karim MJ, Haq R, Azad MB, Mahmood ASM, Khair A, Rahman M, Chowdhury S, Rahman F, Jahan S, **Hafiz I**, Taylor M, Betts H, Mableson HE, Kelly-Hope L. *(Plos NTDs - under review)*